AUSTRALIAN
communications
OCTOBER 1993 The Networking and Telecommunications Management Magazine $5.50

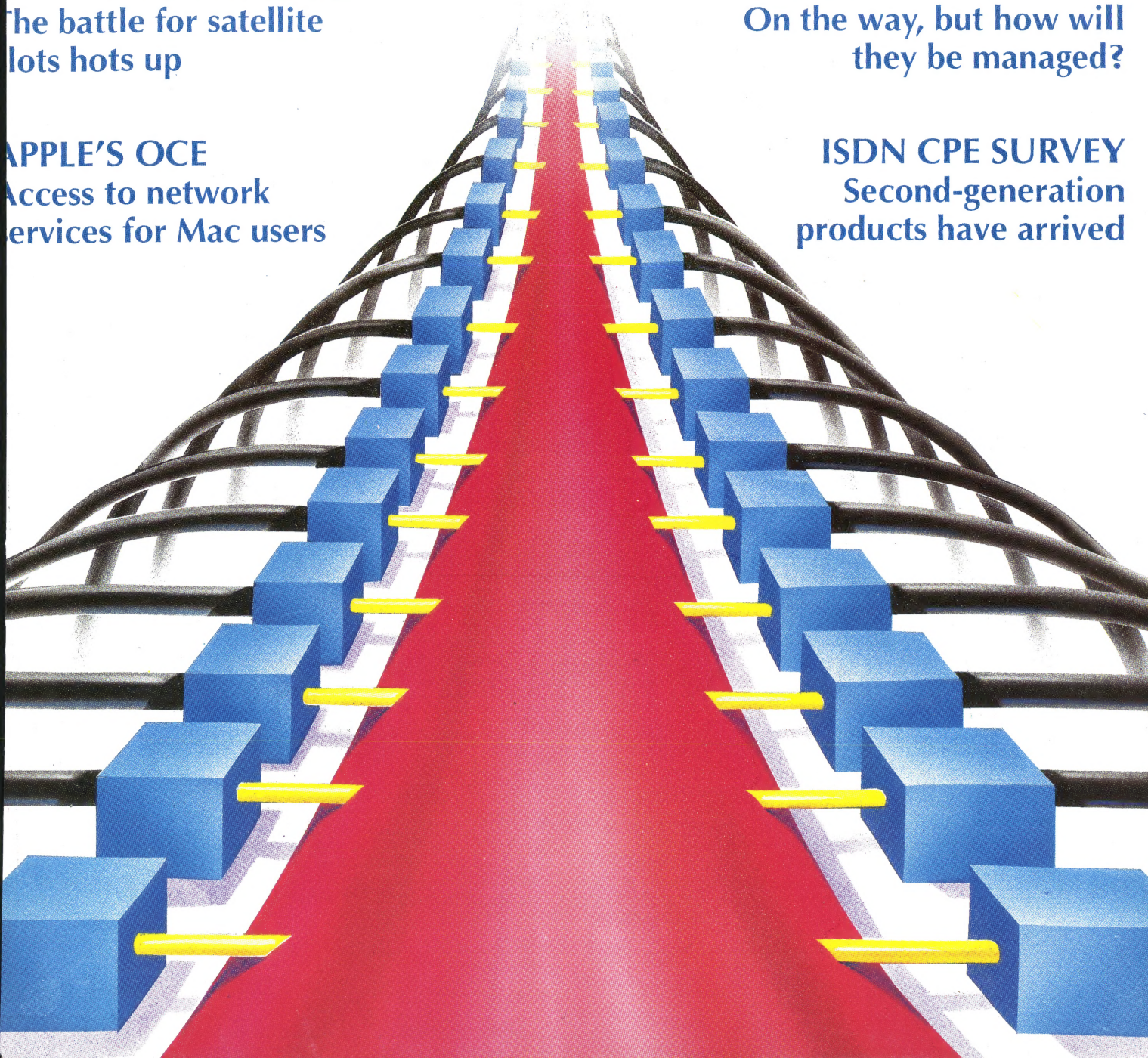
FDDI BRIDGES AND ROUTERS
Help not hype for overtaxed backbones

THE NEW STAR WARS
The battle for satellite slots hots up

HIGH-SPEED WANS
On the way, but how will they be managed?

APPLE'S OCE
Access to network services for Mac users

ISDN CPE SURVEY
Second-generation products have arrived



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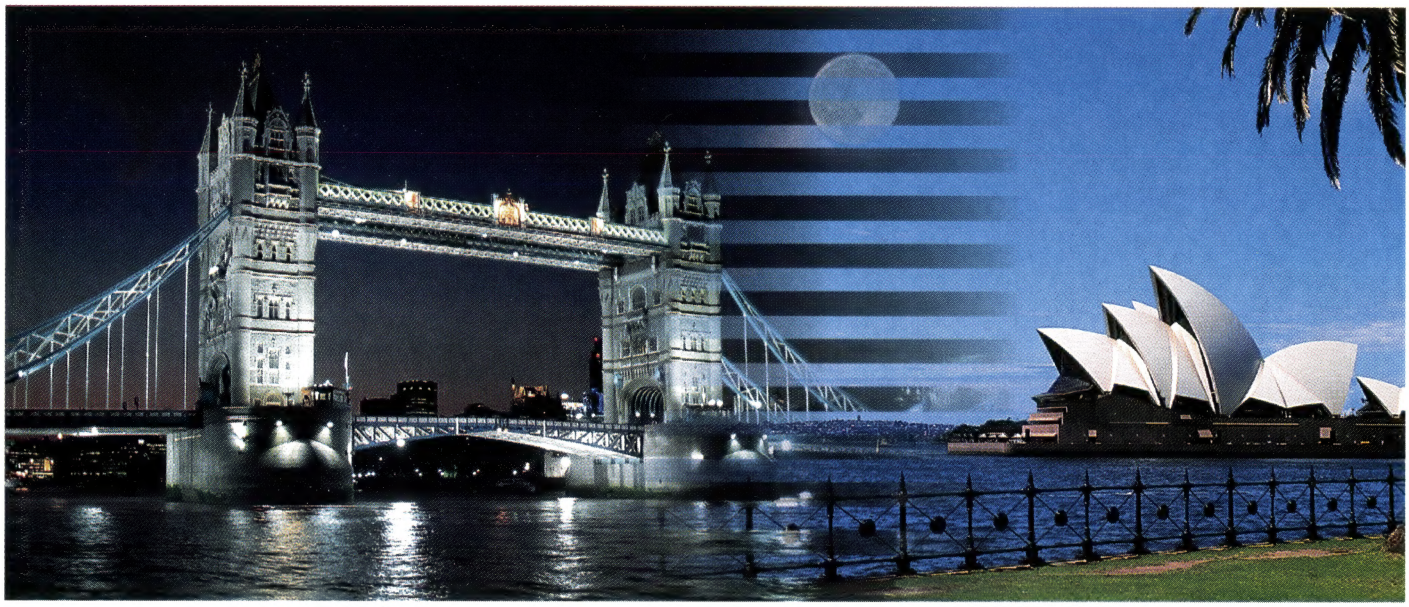

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EICON TECHNOLOGY

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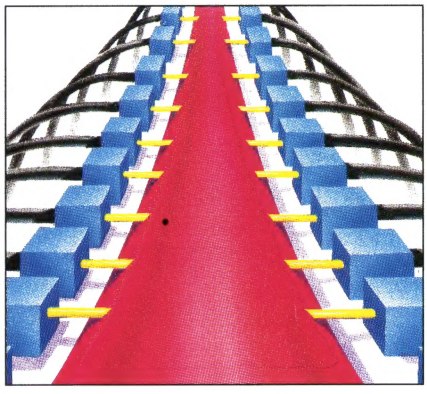
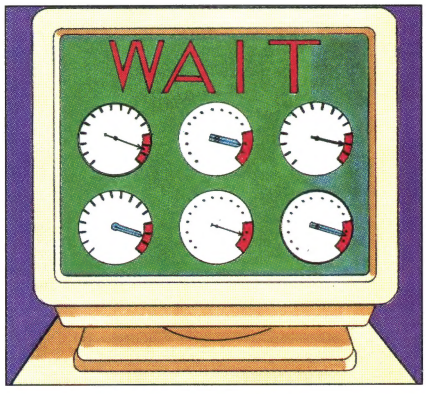


Cover: Tony Pyrzakowski



FDDI 67

Industry gurus may sing the praises of ATM, Fastpac and fast Ethernet, but they're apparently oblivious to the one high-speed technology that can deliver much-needed bandwidth to today's over-stressed backbones — FDDI. The Data Comm Test Lab put together the industry's first evaluation of FDDI bridges and routers and found out that this internetworking gear has what it takes to shunt traffic from overloaded LANs onto 100-Mbps backbones at close to the wire speed of each attached Ethernet and Token Ring. The Lab also took a look at how well these boxes scale and how proprietary schemes for source bridging can slow performance.

ISDN CPE 77

ISDN is a much maligned digital network technology which hasn't and will never deliver the new breed of applications so often put forward by its proponents. Isn't it? Maybe not. ISDN may well have been a long time getting started, but a new generation of customer premises equipment is making network managers take a new look. Where first generation products predominantly provided basic voice and data connection to the ISDN network, the new generation provides greater integration of ISDN network services into user applications. Even better, thanks to Telecom's early implementation of ISDN, Australian developers have a lead in the rollout of these products.

HIGH-SPEED WANS 91

For years, network managers have waited patiently for the arrival of multimegabit WAN services. They've also been waiting for vendors to rally around a single standard for managing network resources. But now that high-speed WANs and SNMP are becoming realities, managers may find themselves cooling their heels a little longer. The reason: vendors and standards groups aren't even close to coming up with a way to bring broadband WAN switches and net management standards comfortably together. Almost all broadband switch vendors are offering SNMP compliance with their products, but most are treating SNMP as a stopgap until a better solution comes along.

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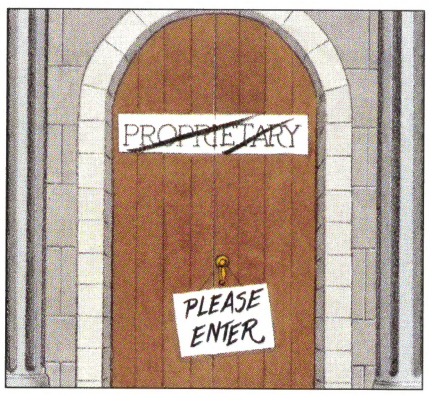

APPLE'S OCE 99

The networking industry loves large numbers, but putting Cray supercomputers on every desktop and joining them with high-speed links isn't the way to get the most out of a computer network. The new Open Collaboration Environment from Apple Computer takes aim at the interpersonal productivity issues that are critical to networking success. OCE is a set of application program interfaces and software modules that let applications communicate, embedding network services like e-mail and fax within the Macintosh System 7 operating system. Here's an early look at what Apple is putting forward as its next generation environment.

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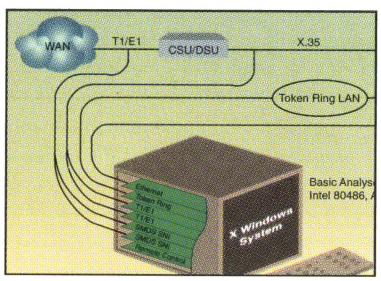

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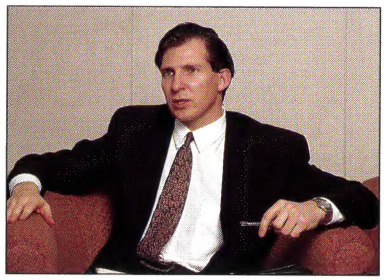

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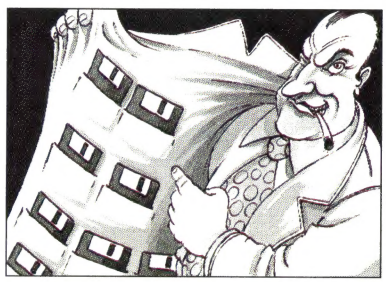
Appointed last year as Austrade's National Manager, Communications and Technology Business Development Unit, Roger Knight's aim is to boost telecoms exports.

LEGAL LINE



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Something Old, Something New

The data communications industry seems to be forever jumping on the latest high-speed bandwagon in the race to get enough bandwidth on LAN backbones to cope with the expected advent of new desktop multimedia applications. In the scramble, it's easy to forget that we already have a high-speed scheme that not only delivers in terms of throughput, but also has a range of readily available, tried and tested products. That neglected technology is FDDI, and our cover story this month takes an in-depth look at FDDI internetworking products. We find the current crop of offerings certainly have what it takes, speeding network traffic from LANs onto 100Mbps backbones at very near the wire speed of attached Ethernet or Token Ring networks.

Of course, for network managers who are required to manage high-speed WAN links across an enterprise network it's a different story. Bottlenecks are still the order of the day, and it's typically been well-nigh impossible to find products from different vendors that can be managed using a single standard. All that is slowly beginning to change, with WAN vendors finally settling on SNMP as a standard for managing network resources, and high speed technologies like ATM, frame relay and broadband ISDN now delivering affordable multimegabit speeds. But it seems most vendors still regard SNMP as a mere stopgap, and it looks as if it will still be some time before vendors and standards bodies are of one mind. Our article, 'Managing High Speed WANs,' starting on page 91, takes a look at the continuing problems and developing management issues for the latest high speed WAN switches.

Also featured in this issue is a follow up to an article on ISDN customer premises equipment which appeared in the October 1991 issue of *Australian Communications*. When that story was written, there was a dearth of ISDN product on the market. Now, two years down the track, Greg Smith finds that second generation ISDN CPE is starting to appear in large numbers, with the latest offerings showing much more innovation and functionality.

Apple has also been hard at work on the product development front, and is set to launch an important upgrade to its System 7 software. Our article on page 99 previews the new Open Collaboration Environment, which is designed to change the way people work together by letting applications communicate and streamlining network services like e-mail and fax.

AUSTRALIAN communications

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CORRECTION

In our September issue we incorrectly reported that Infonet Corporation had changed its name to SingCom (Australia).
What we should have reported is that Infolink Network Services is now known as SingCom (Australia).

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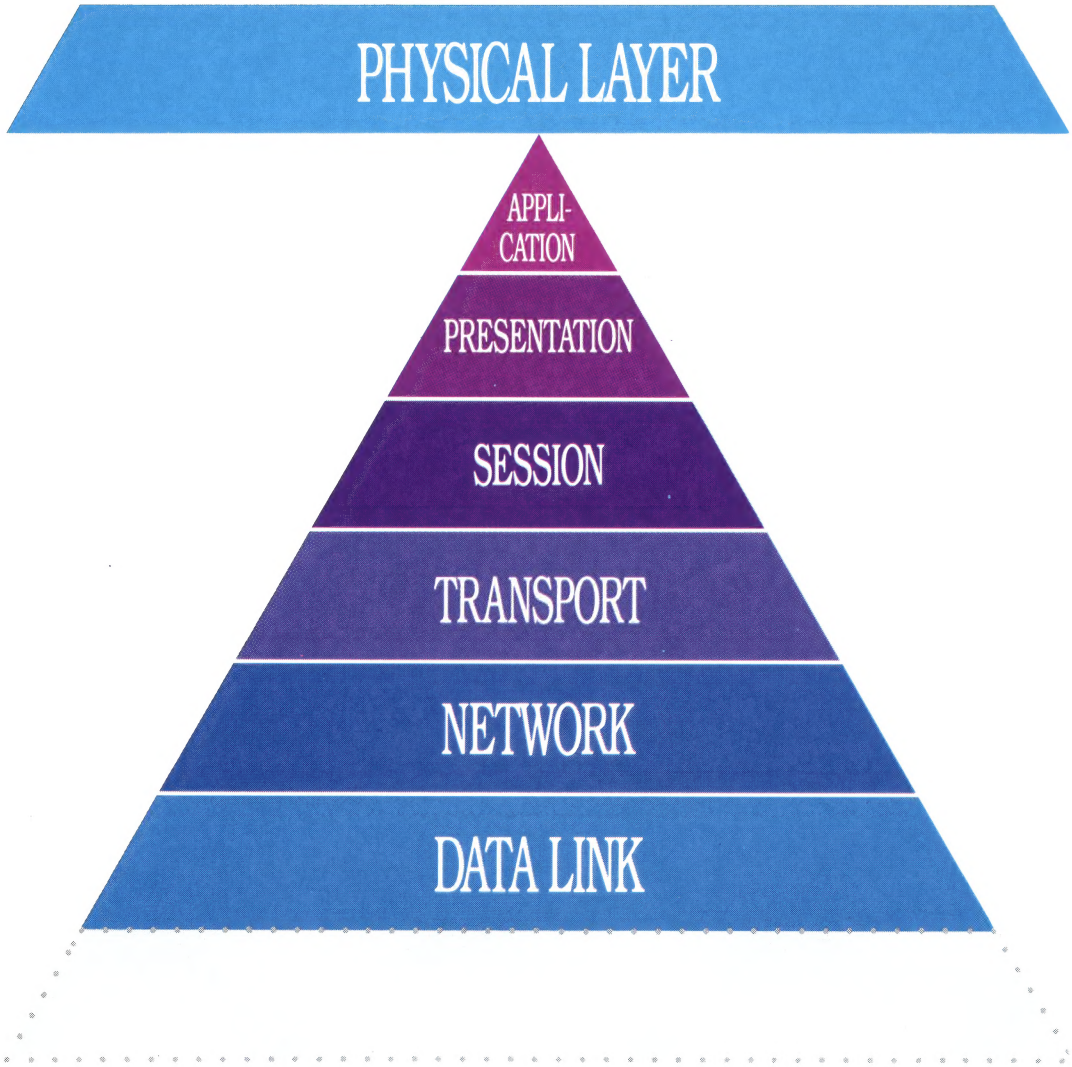

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GSM a Great Success Story

GSM must be the word most printed or spoken in papers, magazines and conferences about modern digital (wireless) telecommunications today, and has been for the last three years. Not everything that has been written has been favourable, and certainly every problem that has occurred has been heavily reported in the trade press.

Where Does it Come From?

In 1982 the European Administrations of Posts and Telecommunications, a group of over 25 nations within the CEPT (European Posts and Telecommunications Conference) decided to constitute a working group called 'Groupe Special Mobile' to define and standardise a new pan-European cellular system (GSM was later changed to mean 'Global System for Mobile Communications').

The concept of roaming between networks in different countries required a commitment for a coordinated implementation. In light of this and the support/influence of the CEC, a Memorandum of Understanding (MoU) was signed in Copenhagen in September 1987 by 12 European countries. This document gave the group of network operators and regulatory authorities who had committed themselves to the GSM standard the name of 'GSM MoU.' Full membership is open to national regulatory authorities and network operators who have a licence, frequency allocation, and who plan to start service within two years.

On September 24, 1991, an Addendum to the Memorandum was signed which made provision for countries outside the CEPT, who were adopting the GSM standard, to become members of the MoU as well.

The MoU group has now evolved to the point where, as of July 1993, there were 58 members ('Signatories') from 36 countries around the world. Operators from 23 European and 13 non-European countries have signed the MoU to date and either already have or intend to bring a GSM network into service. As of July 1993, there are more than 600,000 customers on the GSM networks already in service.

As of July 1993, a wide range of countries had signed roaming agreements with operators in other countries (see the table on page 10). At present, some emerging networks outside of Europe do not have the necessary CCITT standard signalling.

Truly international roaming will be available once the signalling compatibility problems have been solved and standard agreements are signed and agreed by the individual operators.

TDMA Technology

When GSM was in the planning stages in the 1980s, CDMA was examined in depth, and after much debate, TDMA was selected as the technology that would be used for the GSM standard. There seems to be confusion between multiple access schemes (TDMA/CDMA) and complete systems (like GSM and D-AMPS). Claims that TDMA has critical problems of timing, synchronisation, and robustness do not apply to GSM (it *may* be true of other TDMA technologies, although we do not know of any specifics). GSM was designed with these aspects in mind and has *proved* to be very robust.

There are well-known techniques for synchronising a TDMA system, which were developed for satellite systems almost 20 years ago. Satellite TDMA systems actually have more stringent requirements for synchronisation, with shorter time slots and very large distances (36,000-42,000 kilometres) and relative velocities (even for geostationary satellites). Any cellular TDMA synchronisation issues have been taken care of with solutions backed by experience.

The GSM synchronisation scheme has been designed for a maximum range of 35km. This is very adequate for most perceived applications, especially in consideration of the fact that the market trend is toward lower-powered handhelds which would not even cover that distance. However, GSM is specified in Phase 1 to be able to use alternate slots for areas where greater range might be needed. Range extension in such a manner could certainly be used by any carrier with large areas of land or water to cover.

Radio Interference

The GSM standard has been designed with tight specifications to prevent interference with other mobile users (GSM or analogue), with TV, aircraft etc. GSM already co-exists with analogue 900MHz systems in many countries of Europe which have either TACS or NMT 900 with only a single channel guard band.

A TDMA mobile device transmits blocks of data, in the case of GSM, amplitude modulated at the 0.6/5ms rate. GSM does not transmit audio, but the RF carrier is effectively amplitude modulated at that rate. The specifications for GSM include ramping, a technique to minimise interference during power changes, rather than cause it.

Interference from radio transmissions can be generated in any non-linear electrically conducting device. There is a European Directive requiring products to *withstand* electromagnetic field strengths up to specified levels without degradation to their operation, as well as not to cause interference above certain levels. GSM complies with this Directive. Some hearing aids and other products do not. However, there are hearing aids which do meet the requirements, and these work well with GSM.

A recent study on interference to hearing aids used by GSM mobile telephones was initiated in Denmark by the Danish Minister for Communications. The working group was headed by the national Telecom Agency. Apart from the two GSM Network Operators in Denmark, a wide range of interest groups were represented and attended all meetings. Some of the highlights of their findings are as follows:

- Electromagnetic interference is a well-known phenomenon observed for the past 100 years by people living near radio stations. It has been known for more than 20 years that radar signals interfere with hearing aids;
- Up till now, there have been (as yet unsatisfied) expectations that the EEC's Electromagnetic Compatibility (EMC) Directive would ensure that equipment such as hearing aids would fulfill requirements for immunity to GSM, for example. Up until January 1, 1996, manufacturers of hearing aids may elect to observe current Danish regulations (which are closely aligned with the EMC Directive and related amendments), which do not require manufacturers to observe the requirements for emissions/immunity for hearing aids;
- Between 25-50% of hearing aids currently being marketed will be affected by GSM transmission. Not very many cases of interference have yet occurred, due probably to limited GSM mobile telephone distribution. Occurrences are expected to increase as the number of phones rises. But at the same time, the percentage of hearing aids that do experience interference from GSM transmissions will be falling, due to the continuous replacement of hearing aids with

Countries with GSM Networks in Service

Australia	Hong Kong	Portugal
Denmark	Ireland	Sweden
Finland	Italy	Switzerland
France	Luxembourg	United
Germany	New Zealand	Kingdom
Greece	Norway	

Countries Planning GSM Networks

Andorra	Jersey	Singapore
Austria	Kuwait	South Africa
Belgium	Latvia	Spain
Brunei	Malaysia	Syria
Cameroon	Netherlands	Turkey
Estonia	Pakistan	U.A.E.
Iceland	Qatar	

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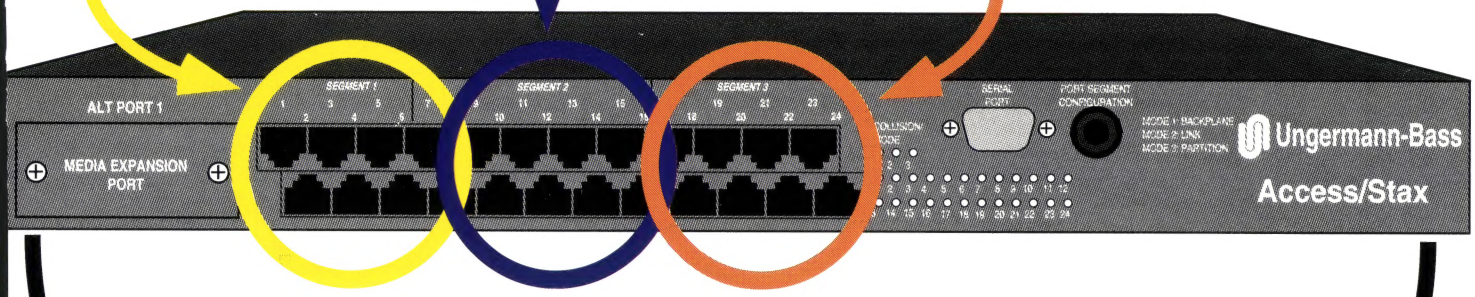

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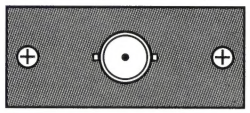
Optional Media Connectors

DB-15 connector
AUI (Thicknet)



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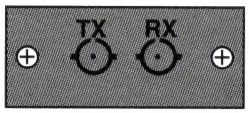
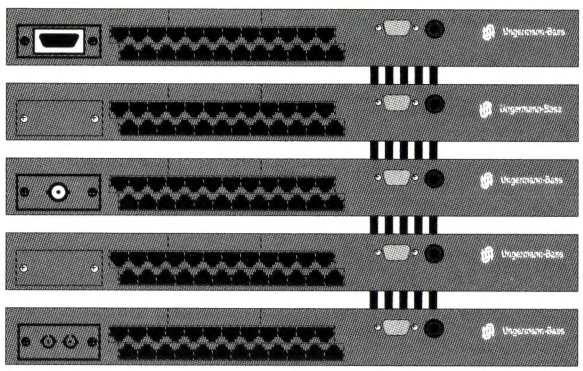
for Thinnet



Fibre (FOIRL)
connector



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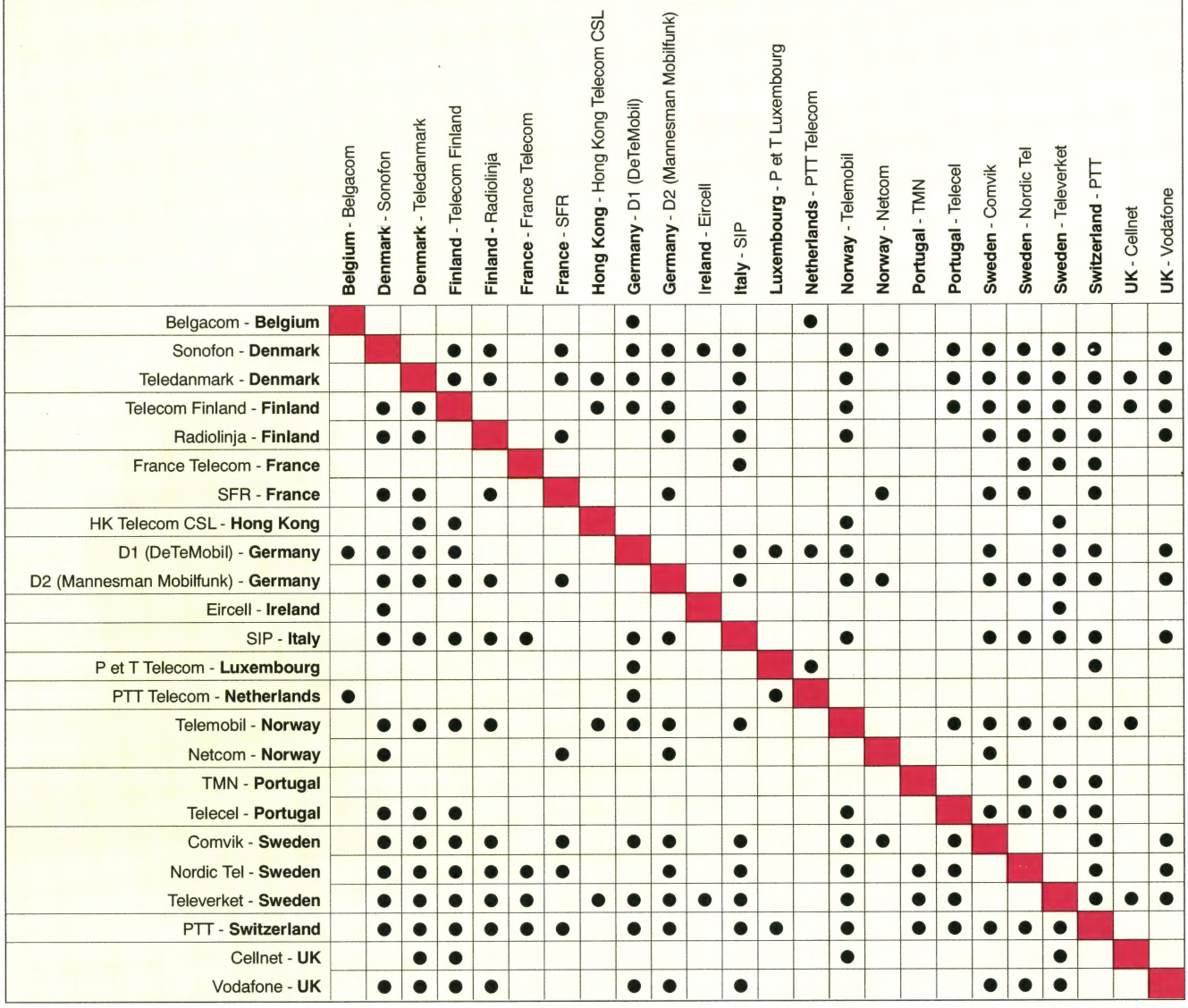


newer models that will have an immunity to GSM transmissions. In 5 - 7 years the risk of interference should have diminished significantly;

- Some more recent models of hearing aids already demonstrate a satisfactory degree of immunity to interference, giving insignificant interference at a distance of one metre from a 2-Watt handheld GSM mobile telephone or two metres away from an 8-Watt GSM mobile telephone fitted in a vehicle;
- Future hearing aids can be designed with an immunity to interference for a price increase of about $A21.40 per unit. It is recommended that they have — or be able to be fitted with — an immunity to ensure that field strengths of up to 10V/m only cause minor interference, supposing that hearing aid wearers would rarely get closer than one metre to a GSM mobile telephone; and
- Adverse effects can be greatly reduced if wearers of hearing aids maintain a certain — not very great — distance from users of GSM mobile telephones.

Reports of GSM interference with some automobile systems recently have prompted a second round of discussion with German car makers, and the results are as follows:

- We know of absolutely no problems at the present time and reconfirmed with Mercedes that neither they nor we know of any problem that exists between a properly installed GSM mobile and their vehicle electronics.
- Opel-General Motors has confirmed that there are no known problems of the nature claimed.
- We know of no interference problems associated with VW automobiles. BMW also confirms no problems with cellular phones when properly used.

(Incidentally, both Ford and Mercedes are marketing their own models of type-approved GSM phones.)

As operators, we are ensuring that we use the most modern radio planning techniques to maintain low wattage output in city areas, thus minimising the prospect of interference. Additionally, handset manufacturers have also improved their products from the early prototype stages to meet the complete Type Approval regime and minimise interference.

There is also ongoing research being conducted by operators, manufacturers, and by independent study groups into all areas of interference associated with a range of digital technologies (GSM/DECT/TETRA).

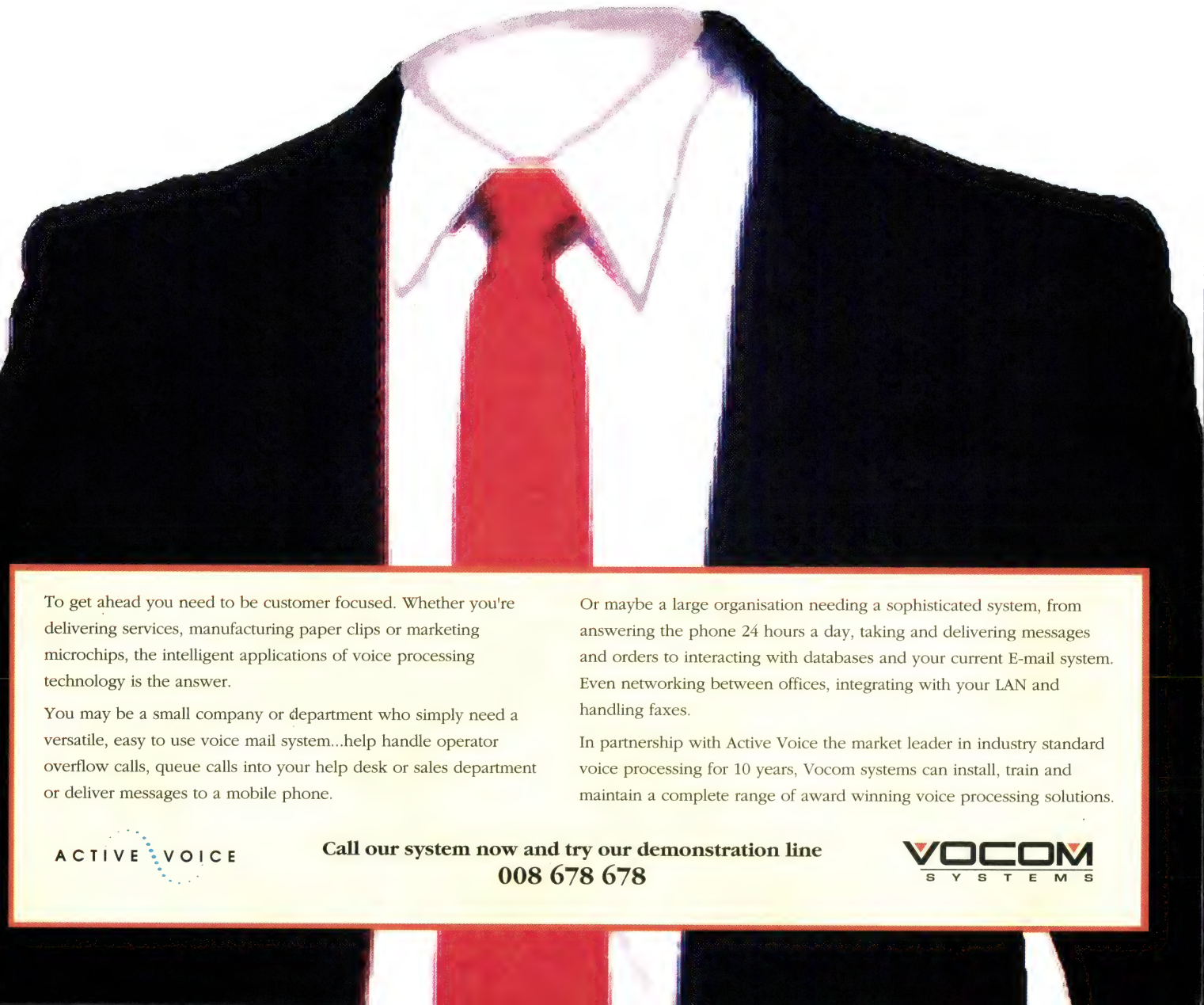
Health Aspects

The power levels transmitted are substantially lower than TACS or AMPS and meet all relevant international standards pertaining to interference, health and safety. GSM specifications have been studied in detail by bodies in many European countries. Their specified safety limits will vary, but GSM power levels have always been well below all limits and will continue to be so.

There is no evidence whatever that the pulse effect from TDMA has any health im-

Get ahead

with voice mail systems



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pact. And we can assure anyone that a GSM transmission has no ELF spectral component whatsoever.

Spectral Efficiency

A lot of work was done in this area in the 1980s in relation to the selection of the radio access technology for GSM. A major conclusion which then emerges from several years of theoretical and experimental work was the following:

'For digital systems, the information theory (Claude Shannon) allows you to predict the maximum quantity of information that you can transmit through a particular channel, irrespective of the access technique or modulation scheme used. How near you can come to this limit is dependent more on the care exercised in engineering your system than on the scheme used.'

The claim that a particular access technique is inherently more spectrally efficient than another one must thus be considered very cautiously. This opinion has recently been confirmed by research teams working on a next-generation system (FPLMTS). They consider it likely that candidate techniques will have about the same performance in terms of spectrum utilisation, and that the choice of the radio technique will be made on the basis of other criteria.

At present, the UK has one of the most difficult spectrum environments due to the high density of people in London, and the existing use of TACS at 900 MHz. But the network operators report that they are confident of having enough spectrum for even optimistic market predictions.

The GSM Success

There are repeated claims that GSM is in trouble and a 'fiasco.' I would like to emphasis that *GSM is WORKING, and WORKING WELL.* Practical experience of networks with many subscribers has been most satisfactory. Consider the features that make GSM unique:

- Pan-world roaming using the SIM card, with no special prior arrangement or subscription necessary;
- Total security against fraud and eavesdropping;
- An integrated system, already feature-rich, and with more features to come.

We are very happy with Phase 1 of GSM, with no more teething problems than would be expected with the introduction of a complex new system. We will soon be introducing many new features and enhancements in our Phase 2.

There was a time in 1992 when we (only half jokingly) said that GSM was the acronym for 'God Send Mobiles.' With over 90 different models currently type-approved, we're still short of phones to sell, and I wouldn't be surprised if the shortages last all the way through 1993, given the number of new networks that will be marketed for the first time, as well as the growth by existing GSM networks. A year ago, nobody would have predicted over 1,000,000 happy GSM customers in service before the end of 1993, but GSM customers will exceed that count *by October of this year.*

Of the 58 Signatories to the GSM MoU group, 14 joined this year alone. The more than 20 Observers are principally waiting for final licence award and/or frequency allocation to become full members.

The first network went into commercial service in July of 1992. By the end of June 1993, there were over 3,000 base stations in use by over 600,000 GSM customers using our networks, representing a capital investment of over $A3,231 million. While other mobile technologies will surely emerge in the 1990s, it cannot be denied that GSM is the success story of the 1990s.

George F. Schmidtt
Chairman, GSM MoU
Member of the Board,
Mannesman Mobilfunk GmbH
Dusseldorf, Germany

At one time we used to talk about the Gnomes of Zurich — the mysterious bankers who ran the economies of Europe. Now we have Euro technocrats who run similarly mysterious devices called 'MoUs' — which is little more than the spin-doctors' Eurospeak term for what we used to call 'cartels.'

Mr Schmitt, as Chairman of the GSM MoU, would attempt to characterise his organisation as 'open,' with 58 members from 36 countries and 29 'observers.' It is just that some parts of the GSM MoU are apparently more 'open' than others. I'd like to know, for instance, how many of the 58 members of the GSM MoU were given access to the OFTEL, DTI and ETSI documents (dating from mid-1988) pointing out the inherent polluting nature of the technology in both the R/F and ELF areas — before they signed the GSM agreement?

Austel assures me that it received no such information before Australia signed — which, I would suggest, constitutes good grounds for suing the pants off the Europeans. And I've recently talked to Ian Hutchings, the head of the New Zealand Ministry of Commerce's radio frequency branch, who complains bitterly that he can't even get cooperation from the European telecoms authorities now. He has had to make informal contact with a Swiss member of the original GSM task force for details of interference studies because official requests for technical details by both the Australian and the New Zealand Governments drew a blank.

Schmitt wanted room in this magazine to reply to some of the accusations that myself and a few other writers have been making about the GSM technology. But what we are treated to here, in Schmitt's article, is not a reply addressing the questions raised, but simply more-of-the-same old propaganda).

He does, however, deal superficially with GSM radio interference, saying it was 'designed with tight specifications' and that it 'already co-exists with analogue 900MHz systems in many countries.' Tell that to Telecom, which has got GSM's R/F interference flooding into its analogue bands; tell that to the NZ authorities who have now agreed that it is necessary to provide a '4 MHz or more' guard-band between GSM and AMPS frequencies — and tell that to the deaf and to the people who are losing modems and computer gear whenever a GSM handset is turned on nearby.

We then hear the same excuses that 'interference . . . can be generated in any non-linear electrically conducting device' (presumably, like your digital watch), and that the GSM interference problems lie with the 'immunity' standards, not with the 'emission' ones. Better gas masks are what we need, not better pollution controls, apparently!

Schmitt also makes a point of saying that 'There is a European Directive requiring products to *withstand* [his italics] electromagnetic field strengths up to specified levels without degradation to their operations, as well as not to cause interference above certain levels. GSM complies with this Directive. Some hearing aids and other products do not.'

But what he has omitted to point out here is that the EMC Directive is incomplete. For emission-levels, it has been specified only for non-transmitters — for electric motors and the like. The European manufacturers of radio equipment have been fighting like mad for the last ten years to stop these emission-interference standards being extended to purpose-built radio transmitters — such as GSM handsets. So far they have succeeded.

So, Schmitt's statement, in reality, tells us that GSM handsets are well designed to prevent other devices interfering with them — a statement which does little to ignite my enthusiasm! Anyway, I would have expected this; with all the EMI that GSM handsets are pouring out, they'd need to be well protected from each other. NZ tests of TDMA handsets show the same; the dual-mode AMPS/TDMA handsets have been well designed not to suffer interference; it is the older analogue-only gear that is getting blasted at 10 paces.

Along with the new Eurospeak, we can also add Euromaths. According to Schmitt, GSM handhelds pulsing (1:8) at 2 Watts, have 'power levels . . . substantially lower than TACS or AMPS' — which have constant power-outputs of 0.6 Watts. I must try this new form of multiplication on my next tax return!

And then, he says: 'We can assure anyone that a GSM transmission has no ELF spectral component whatsoever.'

He is right of course — in the same way that infra-red transmission has no heat component whatsoever. It is only when infra-red waves impact on some physical object and are 'demodulated' for their energy content, that the objects get hot. And it is only when the GSM R/F transmissions (at 217 pulses a

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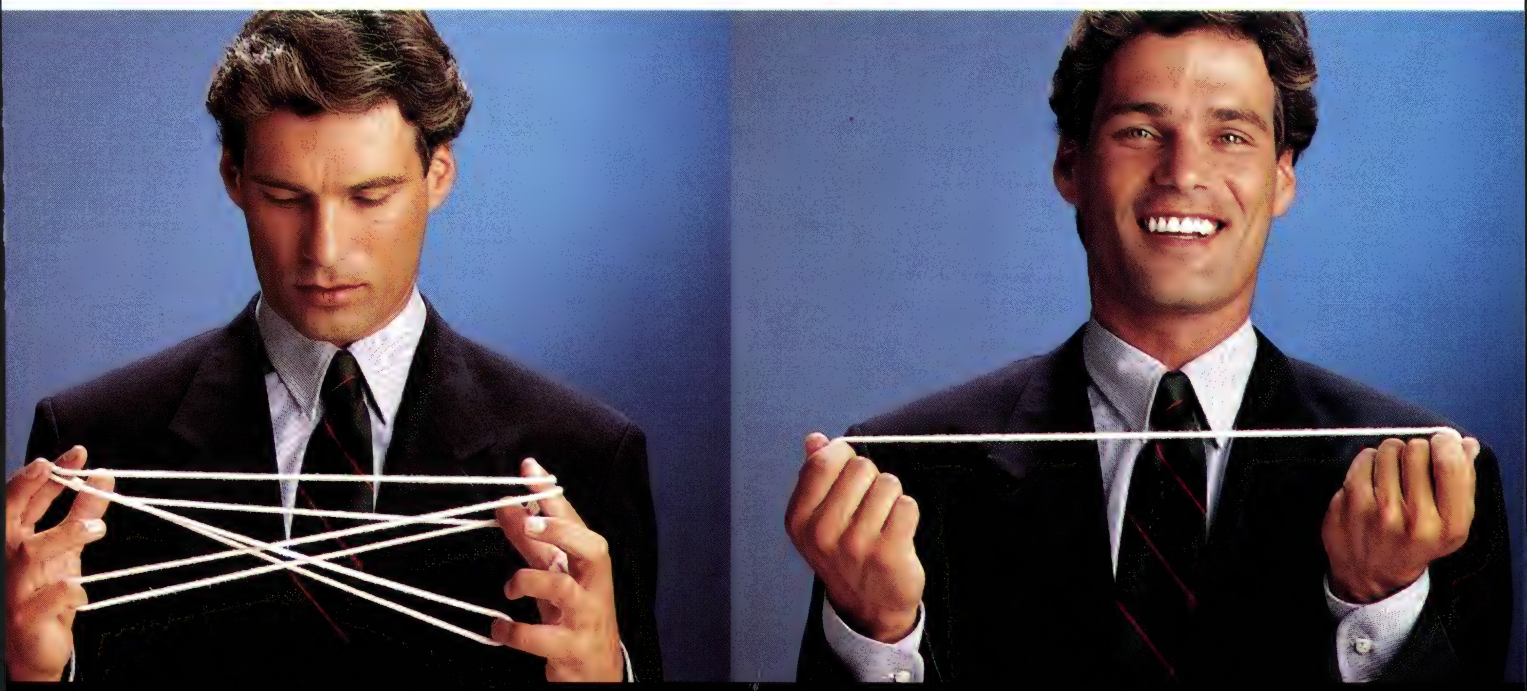

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second) impact on non-linear circuits of some kind, and get demodulated into 217 Hz analogue frequencies and digital-pulse trains, that the ELF appears. There is no 'ELF spectral component,' only an 'ELF spectral consequence.' Unfortunately, this nit-picking is of little comfort to hearing-aid wearers or to radiation researchers, who are not overly concerned with how the ELF got there, but just with the adverse effects it has on lifestyle and health.

Personally, I am more concerned with the fact that digital control equipment will get regularly hit by random bursts of ELF-type digital bytes generated by GSM handsets in the vicinity. We can expect strange and sometimes spectacular results. I've just had a first-hand report that a GSM handset used close to an Apple Powerbook knocked out the computer and modified its hard-disk directory — and it did this repeatedly in a couple of trials. The owner of the Powerbook would not be comforted to learn that there is no 'ELF spectral component,' I suspect.

Poor old Claude Shannon also gets dug up to lend theoretical weight to an unsupported prediction that CDMA will not prove to be any more spectrally efficient than GSM and other TDMA systems (Schmitt doesn't say this outright, but this is the implication). Unfortunately, numerous practical (and public!) CDMA trials run by the various carriers (US West, Bell Atlantic, PacTel, etc.) in the US, stand this theory on its head — by a margin of about 5-to-1. This is not to suggest that Shannon was wrong, but simply that TDMA systems are inherently noisy, suffer from interference, and require guard-bands to protect channels from each other — and all this needs to be included in any Shannon-based capacity calculations (capacity is directly related to noise). But it hasn't been.

A report landed on my desk the other day entitled: 'Interference Potential of TDMA Transmission Structures,' [1990]. It's from the UK's Department of Trade and Industry (DTI) and unfortunately some of it is missing, but the conclusions still provide the flavour:

'4. Details of the tests conducted by DTI are contained in Annexes A, B and C which had had some of the original data omitted to protect the commercial interests of those who have supplied information.

5. The commercial sensitivity of the information in these reports, and similar work done by other organisations within the UK has delayed their release until DTI were fully satisfied that their content was verifiable, so that a premature alarmist reaction would not be attributed to the information they contain.

6. From studying the reports it will be seen that the 'worst' problems exist for GSM, followed by PCNs, then DECT. [The remainder deals with reference to ETSI and CENELEC.]

10. A matter of concern is that these issues are not misunderstood by the public (through inaccurate press coverage) thus general publication is not recommended until possible solutions have been identified and the full extent of the interference potential is confirmed.'

11. Under the terms of the EEC's EMC Directive all equipment is required to 'not cause interference' — and 'not to be susceptible to interference;' thus there is some scope for improving the immunity standards of domestic equipment. The 'probable' generic immunity standard will be 3 volts/metre which most hearing aids and many other devices already meet.

12. More severe standards can be applied on a 'sectorial' basis, e.g. in the 'Automotive Industry' where the safety considerations will require immunity levels of between 10 and 15 volts/metre.'

And it sums up the position (back in 1990) with the words:

'13. This paper has concentrated on 'Hearing aids': it needs to be stressed that many other domestic devices, stereos, radio receivers, television receivers, telephones, etc. are also potentially at risk. Further study is essential.'

Stewart Fist

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Tech-Rentals

Austel Finds 'Lost' Optus Calls

Austel has dismissed claims made by Optus Communications that calls being made on its network in Canberra were being 'lost' somewhere within Telecom's network. The finding was delivered after an investigation prompted by highly-publicised pre-ballot claims made by Optus CEO, Bob Mansfield, in July.

Austel said it has found that the calls, rather than being lost, were in fact successfully completed, but were not recorded in some parts of Optus' information system. In conducting its investigation, Austel examined calls made between 12.30pm and 1.30pm on July 5 and 6 — periods of nil congestion in the Canberra network.

Optus' response to the report was less than enthusiastic. The company's Chief Operating Officer, Ian Boatman, said Optus did not necessarily agree with the findings, and pointed out that the calls examined by Austel represented less than 1% of the problem. Within 48 hours of Optus publicly raising the problem it went away, or was fixed, he added.

Telecom's Group Managing Director, Network and Technology, Doug Campbell, said he was concerned about the impact of the allegations. He claimed they were either a stunt aimed at influencing the ballot process, or a failure by Optus to exercise prudent judgement, and added that telephone users deserved an apology from Mr Mansfield.

Austel chief, Robin Davey, commented pointedly that one beneficial outcome of the investigation was "that the parties have agreed to handle future issues of this type through the processes and procedures specified in their Access Agreement."

Telecom Receives UK Draft Licence

Telecom has received a draft licence from the UK Ministry of Trade and Technology to operate selected telecommunication services in the UK. Two other carriers, Sprint and WorldCom, also received draft licences.

If awarded, the licence would allow Telecom to offer services including international simple resale (IRS) and include full national service in the UK, but it would not allow Telecom to offer international voice services using its own facilities. IRS provides telephone services over an international leased line connected to the PSTN at both ends.

Telecom was shortlisted in March to operate the UK Government Telecommunications Network (GTN). The successful GTN bidder is expected to be announced this month.

Telecom Boosts Vietnam Funding

Telecom is increasing its investment in its Vietnamese joint venture by $155 million, bringing its capital investment in the country to $259 million — its largest single foreign investment.

To be spent between now and the year 2000, around $80 million will be used for a new 560Mbps Thailand-Vietnam-Hong Kong submarine optical fibre cable system, which is due to go into operation by the end of 1995. The investment will also be used to expand international facilities in Hanoi and Ho Chi Minh City, as well as for other projects.

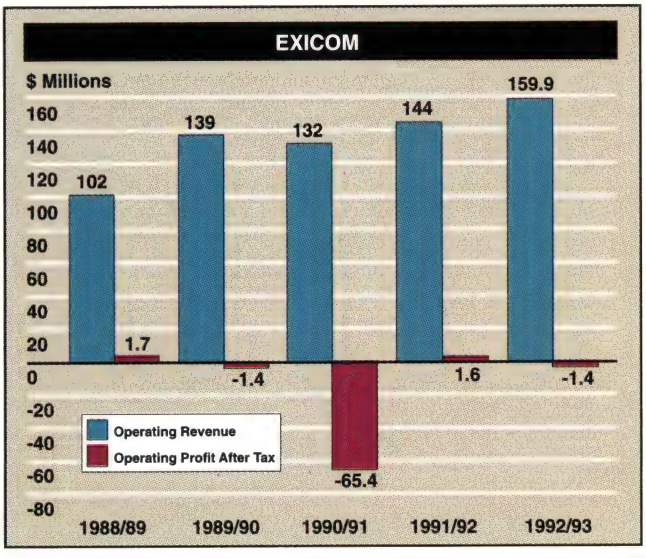
International telephone traffic out of Vietnam grew from 2.6 million to 38 million minutes between 1988-92. Telecom shares the revenue generated by this traffic with Vietnam's DGPT.

Exicom Boosts Sales by 16%

A 16% boost in sales to over $155 million has helped Exicom post a pre-tax operating profit of $4.3 million for the year ended June 30, 1993. However, a tax bill of $4 million after a reduction in the corporate tax rate on carried-forward tax benefits has left the company reporting a $1.4 million loss for the period.

Chairman Barry Capp described the results as "encouraging and broadly in line with expectations" but not satisfactory in terms of the sales achieved or funds employed.

Exicom has been successful in winning a number of important export contracts, including the sale of $5 million worth of switches to China, and the recently announced deal with NorTel to sell telephones to North America. Exports, which now comprise 17.5% of sales, are expected to reach 40% by 1995.

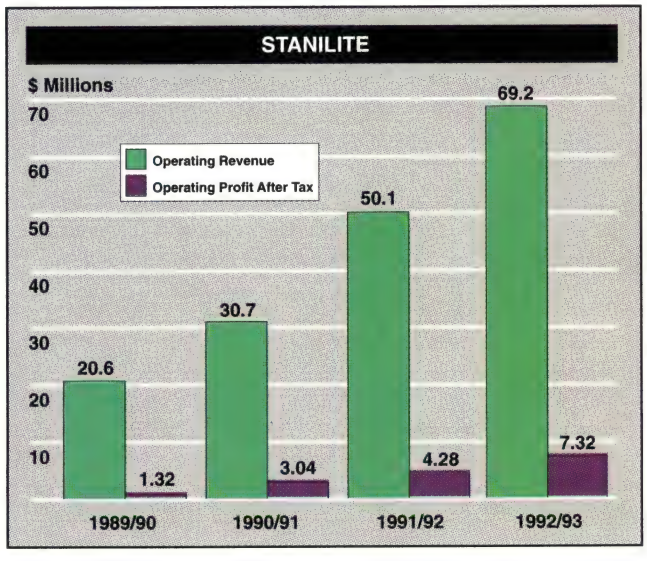


Stanilite Profits Rise 71%

The unstoppable Stanilite Pacific continues to grow at a rapid rate, and has reported a 71% rise in profits to $7.32 million and 38% lift in revenues to $69 million for the year ended June 30.

Chairman John Valder said main contributions to the year's result included its $154 million contract to provide a communications fit-out of 10 ships in the ANZAC frigate project, and the successful completion of a major patrol boat contract for the Royal Hong Kong Police.

Over the past year, the company moved to increase its involvement in telecommunications by acquiring Uni-Lab Telecommunications and T.R. Services. It has also recently announced a $US40 million cooperative venture with two other companies to supply infill cellular systems to Heilongjiang, China's northernmost province.



Alcatel's factory performs all aspects of System 12 exchange production

Alcatel Opens World Class Facility

Alcatel's new digital switching facility and R&D laboratory was officially opened on September 3 by the Minister for Communications, David Beddall.

The company says the centre, located in Liverpool, Sydney, is one of the most advanced complexes of its kind in the world, and represents an investment by Alcatel of over $100 million. It is currently manufacturing the company's System 12 exchanges for both the domestic and overseas markets, and has a production capacity of more than two million lines per year.

Alcatel has already delivered over 350,000 System 12 lines to Telecom, and has announced a new order for 21 exchanges from the Post and Telecommunications Authority of Heilongjiang province, China. The order brings the value of System 12 exports to China to $75 million.

Optus, Telecom Share DFAT Deal

The Department of Foreign Affairs and Trade has awarded major contracts to both Optus and Telecom for the supply of telephone and other communications services to its foreign embassies.

Optus' slice is worth around $7.5 million, and involves the provision of dedicated network services linking DFAT's Canberra offices with 14 embassies and high commissions. Optus will work with its minority owners C&W and BellSouth to provide the international services. The deal represents Optus' first major government contract.

A larger contract estimated at around $16.5 million has been won by Telecom to supply fax, voice and data services to the remainder of the Department's 82 international posts. US-based Sprint will reportedly provide a VPN for these posts under contract to Telecom, with additional requirements sub-contracted to SITA. Both contracts are for three years.

Scitec Back in the Black

Scitec Communication Systems has reported a return to profitability during the six months to June 30, with an operating profit after tax of $512,000. The positive half-year result brightens an otherwise poor 1992-93 performance for Scitec, in which the company posted an after-tax loss of $17.3 million and suffered a $5.1 million decline in revenues to $36 million.

Company officials attribute the losses to write-downs associated with intellectual property and the termination of R&D syndicate contracts.

Sales remained fairly constant at $33.1 million, but export sales dropped to $3.7 million. Sales in Australia and the Asia Pacific displayed strong growth, rising 15% and 6% respectively.

To pursue regional growth Scitec has appointed distributors in South Korea and Malaysia, and expects to achieve total exports of $50 million in these markets over the next five years.

In Brief

PacRim Financial Network has extended its value added network to New York in an expansion of the company's existing New Zealand, London and Hong Kong services. Leading stockbroker, J.B. Were, has signed on as one of the first users of the new link.

The Communications Workers Union has signed an agreement with Telecom guaranteeing it will maintain strategically important Defence communications links during industrial disputes.

Johanna Plante has resigned from her position as an Austel Board Member to take up a position with Pacific Star Communications, where she will be responsible for business development in Victoria and Western Australia. Plante joined Austel as an Inaugural Member in 1989.

SunNET, the Queensland Government telecommunications facilities manager, has announced it has signed a five-year $250 million Strategic Partnership Agreement with Telecom, which it says will guarantee tariff savings of more than $30 million.

Krone has been selected by the University of Sydney to supply Category 5 structured cabling as part of a massive program to completely replace all outmoded wiring. The University has already begun wiring or re-wiring over 21 major buildings.

Telecom has won its Federal Court case against the Trade Practices Commission over the TPC's directive that Telecom publish extensive advertising to redress what the Commission said were misleading and deceptive statements in a brochure and letter to consumers. Mr Justice Hill ruled that there was no real purpose to be served by the publication of corrective advertising.

Datacraft has signed a Value Added Partner agreement with X.400 applications software developer, Isocor, to distribute and support the US company's X.400 product family.

Fujitsu and Ericsson have both announced export plans worth hundreds of millions of dollars. Fujitsu will sell a new Australian-designed and developed automatic teller machine through 76 Fujitsu and ICL offices worldwide. Ericsson has unveiled a new $30 million test plant lab system, and has designated Australia a major R&D centre and a hub for the company's Asian expansion.

Communications Networks International (CNI) will co-market desktop videoconferencing with Telecom Business Video Services. CNI will assist in sales and provide products, installation, training and maintenance. Telecom will supply ISDN Microlinks, pre and post-sales support, and implementation.

Alcatel Australia has been awarded a contract to supply its Australian-designed and developed Alcatel 2740 telephones to Hong Kong Telecommunications. The order is worth over $1.8 million, and involves the supply of three different versions of the 2740 to Hong Kong Telecom for use on its CITINET service.

Optus' new satellite earth station at Oxford Falls in Sydney was opened recently by NSW Premier, John Fahey. The station cost $11 million, and will be a key facility in the transmission of international calls, with the ability to handle 2,000 simultaneous calls.

PhoneCard, a company 39% owned by the Thai subsidiary of Matrix Telecommunications, has won a major contract to establish and operate over 11,000 public phone booths and 100 public pay fax stations in Thailand.

Datacraft has signed a major agreement with QPSX Communications for the sole rights to distribute and support QPSX's cell-switched Broadband Networking Systems in Australia.

Alcatel Australia, has joined Telecom's Enhanced Distribution Channel (EDC) Program. From now on, Telecom will be able to offer mutual customers business solutions which combine each organisation's products and resources. Launched in 1992, the EDC program now involves over 120 companies.

Ericsson claims to be the first telecoms company in Australia to receive joint certification by the British Standards Institution and Standards Australia to the international standard ISO 9001.

JNA Telecommunications has won a contract to provide telecommunication infrastructure equipment to build a digital network in Ho Chi Minh City. The equipment is being supplied to Telstra, and JNA will also provide support and assist with installation.

In Brief

Northern Telecom has signed a contract worth $US53 million with the Beijing Telecommunications Administration for the supply of DMS SuperNode central office switching systems expected to add over 340,000 lines to the Beijing network.

Cisco Systems has reported results for its fourth quarter ending July 25 of net income of $US53.7 million or $US0.41 per share, from net sales of $US205.2 million. The results compare with net income of $US27.2 million or $US0.21 per share, from net sales of $US110.6 million, for the same period last year, and represent increases of 97%, 85% and 95% respectively.

Inmarsat has two new members — the Slovak Republic and the Republic of Georgia — bringing the number of members to 69.

Retix has been selected by McCaw Cellular Communications to supply routers for McCaw's US nationwide Cellular Digital Packet Data (CDPD)-enabled network. The contract involves the provision of RX7000 multiprotocol routers and OSI technologies.

Philips claims to be the first company to supply an operational transmission system based on ATM technology, as part of the European Research and Development in Advanced Communications Technologies in Europe (RACE) project.

AT&T Network Systems in the Netherlands and AT&T Prague have won a contract worth $US12 million to extend the Czech Republic's existing SDH system. The contract involves the delivery and installation of SDH line systems, multiplexers and fibre optic cable. Work will begin to extend the system this month, and is expected to be completed by the end of 1994.

The Bulgarian Committee of Posts and Telecommunications has awarded a national paging licence to the Radio Telecommunications Company, a joint venture in which Cable & Wireless has a 49% shareholding. It has also awarded a contract to Ericsson to install an NMT450i mobile telephone system which is scheduled to become operational by the end of the year.

BT has announced the commencement of its ISDN link to Ireland. The company claims its own international ISDN traffic has increased by 450% over the past year, and it now has 21 ISDN links covering 19 countries, including most of Europe, Australia, Canada, Finland, Hong Kong and the US.

GPT has recruited the Shanghai International Digital Telephone Equipment Company (SIDEC) to supply and implement CT-2 telepoint systems by GPT throughout China. SIDEC is a joint venture between GPT, China's Ministry of Post and Telecommunications Industries Corporation, and CITIC Technology Shanghai.

Russian telephone operators have cut off international lines to the former Soviet Republic of Georgia because of a dispute over payments. The move leaves Georgia without telephone access to the rest of the world, because all calls out of the country must be routed via Moscow. Russia's Deputy Minister for Communications said the problem involved non-payment of bills, but the Georgian telecommunications ministry claimed Russia is demanding a new deal involving the payment of a $US75,000 tariff.

Cable & Wireless has amalgamated its US divisions Cable & Wireless Communications and Cable & Wireless Americas. The new company, to be called Cable & Wireless Inc., will be responsible for all C&W sales, operations and business development in North America, and will be headed by Alan Peyser, who originally founded Cable & Wireless Communications in 1975.

GPT says it has supplied Africa's first computerised operator system. The system, which is located in Kenya, is the first of 16 systems GPT will install for the country's Communication Supplies Limited and is able to handle 600 simultaneous calls.

Oftel, the UK telecommunications industry regulator, has ruled that special discount schemes offered by BT are anti-competitive. Oftel found that BT's discounts were priced at a level which did not cover costs, meaning it was charging itself less than it was charging other carriers for equivalent services.

Greece will receive an ECU100 million telecoms package from the EC after agreeing to set up a separate regulatory body. The money will be used to computerise billing operations at OTE and to provide digital links in the Athens area.

AT&T Swallows McCaw Cellular

AT&T will 'merge' with mobiles operator McCaw Cellular Communications after the US giants agreed to a $US12.6 billion all-stock transaction where each McCaw share will be exchanged for one AT&T share.

Announced in mid-August, the decision to merge is the result of discussions which followed the announcement last November that the two companies were planning an alliance in which AT&T would purchase a one-third interest in McCaw for $US3.8 billion, including the purchase of 35.8 million McCaw shares from BT. Under this current deal, AT&T will acquire BT's shares at the same prices and on the same terms as other McCaw shares.

AT&T Chairman, Mr Robert Allen, emphasised that the deal was not an attempt to re-enter the local call market. "More than 99% of all cellular calls go through local telephone companies. It will be years, if ever, before that changes," he said.

The agreement is still contingent on regulatory and other approvals, although AT&T expects it to be completed within a year.

Ericsson Boosts Performance

Ericsson's order book for the first six months of this year increased 27% to SEK34 billion ($7.9 billion), up from SEK26.7 billion ($6.2 billion) in the same period in 1992. Consolidated net sales rose by 35% to SEK27 billion ($6.3 billion) while pretax income remained stable at around SEK1.2 billion ($280 million). Ericsson said income for the entire year 1993 is expected to at least double compared with last year.

Radio communications (including mobile telephony) is the company's largest single business area, while the largest market is Italy, which accounts for 12% of consolidated net sales.

NT/Motorola in Cellular Split

Northern Telecom and Motorola have announced the abandonment of their joint venture, Motorola Nortel Communications, which they had set up to market cellular infrastructure systems.

Observers said the demise of the venture can be attributed to customer dissatisfaction at being unable to deal with the parent companies directly, and to the fact that Motorola is backing CDMA technology, while Northern favours TDMA.

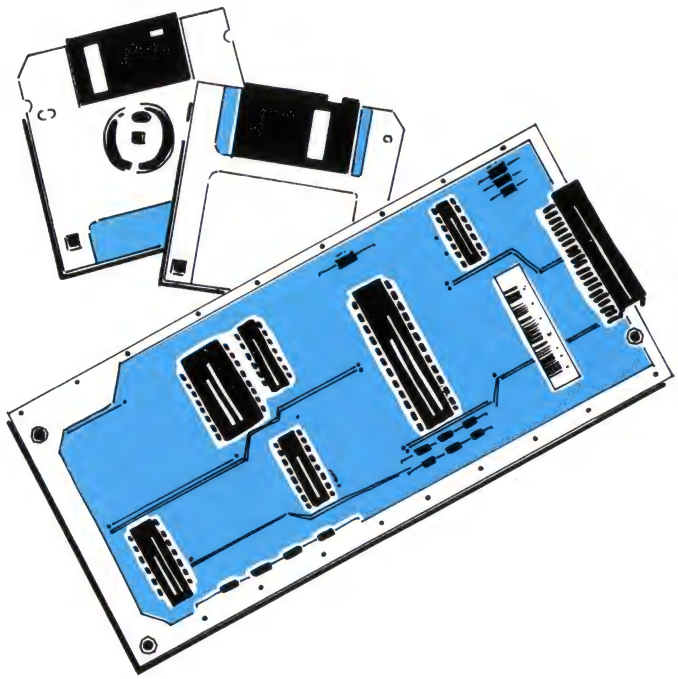
Each company is planning an analogue system based on Motorola radio technology and NT switching. An integrated CDMA system is also planned. (Telecom*europa*)

Asian PTTs for Sale

While Singapore prepares for the float of Singapore Telecom this month, up to 10% of Korea Telecom may find its way onto the market at the same time.

The first of three tranches intended to dispose of up to 25% of the company over the next seven years, around 6-8% of Singapore Telecom will be placed on the block in the first installment. As many as 1.3 billion shares will be offered in three classes: Group A shares, which will only be available to Singapore citizens and will be sold at a fixed price, but at a 40% discount given in the form of bonus shares; Group B shares, which will be restricted to Singaporeans and offered at a fixed price with no discounts; and Group C shares, which will be available to both local and foreign investors, with the floor price mandated to be equal to or above the fixed price of Group B shares.

Hinted at by South Korean government officials last month, proceeds from the sale of Korea Telecom will be used to finance infrastructure projects.



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National Fibre Study Funded as TV Gets Active

As interactive television services in Australia draw near, the Government finds $1 million for a fibre-to-the-home study.

In what Shadow Communications Minister, Senator Richard Alston, labelled a 'direct steal from the Clinton-Gore information super highway concept,' the Federal Government allocated $1 million in the 1993-94 Budget for a study into the development of an optical fibre network in Australia. Foreshadowed by Paul Keating in his pre-election policy speech, the funding is a sign that at last the Government is taking some long overdue initiatives to promote the development of broadband communications to Australian homes.

But while it's likely to be several years at least before a truly national fibre network takes shape, a taste of broadband-style services may be just around the corner. After nearly 30 years of television broadcasting Australia is on the verge of the next quantum leap in technology: interactive television.

Close to Reality

A company called Interactive Television Australia (ITVA) has already gained a fair degree of publicity with its search for $173 million investment capital to enable it to provide interactive TV services to 250,000 Australian homes by 1995. In August, Tandem Computer emerged as the first company to sign up, announcing a $20 million stake. Tandem will provide computer hardware and telecommunications interfaces for the project. Telecom is also looking closely at the possibility of investing.

ITVA has an agreement with the Seven network to use its technology in Seven's planned trials of interactive TV scheduled to take place in Adelaide next year.

ITVA is planning to use a US developed technology, the Video Encrypted Invisible Light (Veil) system which employs a set-top unit in individual homes, connected to the control centre over the phone line. The unit is programmed by signals fed into it along with the TV program. Users make their input via an infrared remote control unit similar to normal TV and VCR remote controllers.

Meanwhile other companies have been working away, testing the market, developing plans and signing partners. Interactive television is closer to becoming a reality in Australia than most of the nation's couch potatoes realise. First cab off the rank is likely to be NTN Australasia Ltd which plans to launch a commercial service before the end of this year. NTN will be able to do this so early because it will not be going into individual homes but into many pubs, clubs and other popular gathering places already served by satellite-based television programme transmissions.

The company has already carried out several trials in pubs and clubs in the Sydney area using trivia games. The questions are displayed on a TV screen and viewers use the interactive technology to submit their answers which are fed back to a central control unit. The scores of the rival contestants are then displayed on the screen.

For the trials this was a purely localised operation but NTN is now setting up a control centre in Australia to take viewer input down the phone line from any number of establishments.

Response from operators of premises where it has trialled its trivia nights has been good and NTN is now looking for partners. According to sources close to the company, it is negotiating with "at least two major broadcasters and major communications companies to participate in the venture."

NTN is the Australian licensee of technology developed by US interactive TV operator, NTN Communications Inc. NTN's technology uses a keypad, known as a Playmaker, for the viewer input device. This connects by a wireless link to a PC which then communicates to NTN's control centre over the phone line. Printed overlays are used to configure the keypad for different types of interactive programming.

One of the most popular applications in the US requires participants to pit their wits as football experts against other teams. Operators in the NTN control centre monitor a live game while it is being broadcast to participating venues and create questions which require participants to predict future plays via the Playmaker. Their results are fed back to the control unit and their score

against other teams, often in another part of the country, is displayed on a second TV.

However, the long term goal of interactive TV operators is not simply to take viewer feedback in response to programme output but to allow each user to choose his or her individual programming. For example, television news could feature a summary and give viewers the option of choosing which items they wanted to see more coverage on.

Such options will only be possible on broadband cable networks, and one organisation plans to use Telecom's fibre-to-the-home trials to test its technology.

Sydney based Access Systems has already gained the interest of the Department of Transport and Communications (DOTAC) in its hybrid technology for interactive TV. It was recently demonstrated to government bureaucrats in Canberra.

A preliminary version suitable for use on narrowband networks combines local storage of high bandwidth information such as images with low volume data transmitted over the phone line. High volume data is stored on a CD-I (compact disc interactive) on the user's PC.

Access says it is working with Digital Equipment Corporation, Microsoft and Siemens to develop technology for its proposed service and is also seeking finance from Telecom for its pilot programme.

Communications Futures

In another move of equal significance Communications Minister, David Beddall, announced on August 30 a 'Communications Futures' project. It will focus on market responses to technology options and the implications for regulation. Full details of the study's steering committee have yet to be announced but is understood that DOTAC's Mike Hutchinson and media commentator Fred Brenchley will be appointed.

The Minister told a Communications Research Forum at the Australian National University on 30 August that the study would build on an ongoing study by the Bureau of Transport and Communications Economics (BTCE) on the economics of the convergence between broadcasting and telecommunications. The study will be funded with resources already allocated to the BTCE.

The announcement appears to be a modest concession to statements contained in a report prepared last year as part of the Service Industries Research Program, a joint initiative by the then Department of Industry, Technology and Commerce and the Australian Coalition of Service Industries.

The report — 'Public Policy Issues and Service Industries Opportunities for Australia and Digital Video Communications — warned that there was a limited window of opportunity for Australia to capitalise on the integration of visual media and computing. It called, among other things, for a single *Communications Act*, government funding and the establishment of a high level committee to ensure that these opportunities were not missed.

The consensus among most pundits is that the integration of visual technology with computing through multimedia, interactive television and virtual reality will create an industry with the potential to dwarf present day television manufacturing, broadcasting and programming.

Brenchley, in his *Australian Financial Review* column just after the Committee was announced said the BTCE study was a bid by Canberra to stay ahead of the game. 'In the early 80s Canberra bowed to pressure from vested interests and banned pay TV for a decade. The cost, in terms of falling behind in the global communications business, has been high.'

This may not be the case. The delay may now allow Australia to develop the optimum network for delivery of these future services and create an environment where market forces in the new industry are freer to operate than they are in, for example, the US where entrenched dominant communications carriers and cable TV operators are now seeking to exploit their infrastructure to also dominate the emerging markets.

Announcing the Communications Futures study, Beddall said that it and the $1 million allocated for a national fibre optic network study (to a newly constituted fibre optic 'Expert Group') would help ensure that public debate was informed and that regulatory developments keep in step with the times. In comparison to the mighty media and communications empires poised to develop the technologies and services that future broadband networks will support such an effort seems puny. As the DITAC/ACSI study said, there is 'a narrow window of opportunity.' Australia is not likely to have a second chance to get it right.

Stuart Corner is the Editor of Exchange.

Mobile Communications

Vodafone Says Hello

However it performs commercially in the short term, Vodafone's entry to the Australian mobiles market serves the symbolic role of keeping the dream of open competition alive. It should also help allay fears in Canberra and elsewhere that the Government may have merely replaced a 'lazy monopoly with a comfortable duopoly.'

A majority-owned subsidiary of the UK Vodafone Group, Vodafone Pty Ltd could be viewed as being blessed in tough economic times by being a player in an almost recession-proof market. But while Telecom and Optus are enjoying analogue mobile growth rates that are the envy of many other industries, Vodafone may be in for a long wait for profitability because of its commitment to GSM technology — there are only a few thousand digital cellular subscribers in Australia to date.

Rolling out in Sydney, Melbourne and Canberra this month, with services extending to Brisbane, Darwin, Hobart, Adelaide and Perth from the end of March next year, Vodafone will be hoping that its lower prices, based on its micro-cellular network (MCN) 'technology' for use over limited geographical areas, appeals to a market where cost is king (see 'Arena's MCN: Great Technology or Great Marketing?' *Australian Communications*, March 1993). Vodafone already has CT-2 cordless telephone services in its sights and aims to tackle Telecom's Talkabout product head-on.

Paying $140 million for the 25-year third mobiles licence in December last year, Vodafone, then known as Arena GSM, won the bid largely by committing itself to GSM. AAP took a three-year 10% equity option in the venture and GSM's fortunes in Australia could well decide whether the media-communications group ultimately exercises the option.

Vodafone's Managing Director, John Rohan, says building the base stations and getting the network functioning before the Sydney-Melbourne-Canberra launches had accounted for a sizeable slice of the $500 million the company will spend in Australia over the next few years with companies such as John Holland Construction & Engineering, Ericsson, Fujitsu, DEC, Project Supplies and Amec Construction.

Rohan says Vodafone's GSM services should benefit from the fact that analogue mobile sales have reached around 30,000 per month, and that the system is overloaded, causing frequent cross-talk and drop-out problems. "We'll get a reasonable percentage of that 30,000, especially from among those people who are concerned with security, such as lawyers, accountants, business executives and politicians," he says.

Conceding that GSM handsets are not cheap, at anywhere from $1,700-$3,000, Rohan says this will drop dramatically over the next 18 months. While Vodafone in the UK went from 0-5% of the market against Cellnet in a very short space of time, he did not think this could be repeated against Telecom and Optus, and the company will not be looking to break even under two to three years.

"But I do see us getting a reasonable percent of the increase in mobile subscribers out to the year 2000. Australia is projected to go to 11% mobile usage by the end of the decade from the present 4-5%. That would equate to some 1.8 to 2.5 million users, and

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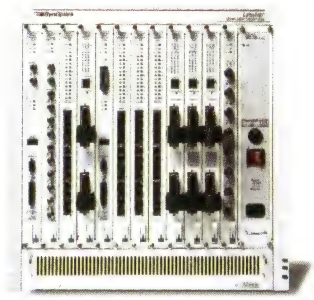

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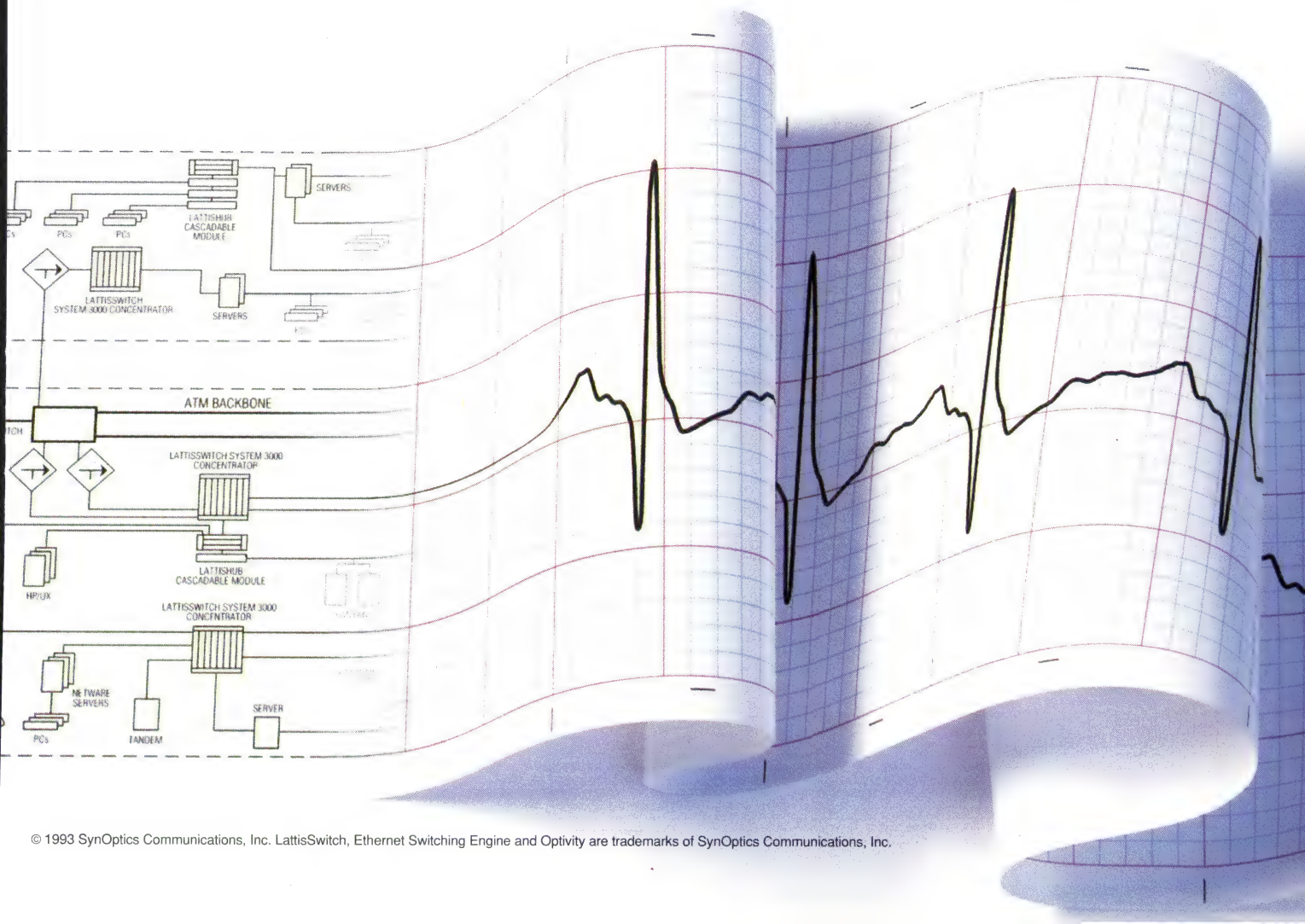

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I would like to think we'd pick up about a quarter of that increase."

Rohan says that Vodafone now employs 100 full-time staff, and the number would rise to 1,000 over the next three to four years. "There'll also be plenty of other jobs created by small service providers and suppliers, which will grow as we do," he says.

Even before its Australian launch, Vodafone was expanding its horizons into the Pacific from its new Australian base, recently entering a joint venture (49%) with the State-owned Fiji Posts and Telecoms (51%) to build and operate the country's first cellular telephone network. Much of the design, technical and training skills will come from the Australian company, while the network itself will be operated by Fiji nationals when it launches in the first half of next year.

Telecom, Optus Unconcerned

So, how are Optus and Telecom responding to the debutante? According to an Optus insider: "We don't feel threatened. Apart from the launch events, there has been very little advertising or other activity by Vodafone so far. But naturally enough, the arrival of another player has been factored into our plans and our strategy teams will be keeping a very close eye on them."

John Rohan

National Manager of Telecom MobileNet, Tim Herring, takes a more fraternal view. "With the introduction of Optus, we saw the market grow and we expect the market to grow even further with another player. As a network provider, Vodafone has around 870,000 subscribers in the UK in competition with Cellnet, which has around 730,000. But as a service provider, Vodafone has only around 180,000 customers, which is pretty small," Herring says.

"We are the network provider for some 750,000 analogue subscribers, and we are ahead of Vodafone as the service provider to 600,000 of those. Optus accounts for the other 150,000."

"Vodafone is quite a good operator, but we don't think they're anything to fear. We also do a lot of things better here in Australia than they do in Europe. When we activate a customer, it takes as little as 10-15 minutes to get them up and running, whereas in Germany, for example, it takes two to three days."

Consultant and *Mobiles* newsletter publisher, Maurie Dobbin, says the good news for all players, not just Vodafone, is that mobile telephony is growing faster than almost any other industry sector.

"Telecom may have lost 18% of the market to Optus, but Telecom's subscriber base consistently grows faster than their own estimates," Dobbin says.

"I've always said Vodafone faces the task of producing in nine months what Optus has done in 18 months. It's a tough ask."

Bernard Levy

The Ballot

Telecom's High Hopes For Melbourne

Optus CEO, Bob Mansfield, described the 11% market share gained by his company in the Canberra ballot as "great news" but Telecom is tipping that the Melbourne and Brisbane ballots may not prove as positive for the new carrier.

Conservative Melbourne, home to Telecom headquarters, and beautiful-one-day-perfect-the-next Brisbane will very likely return the least favourable metropolitan preselection ballot figures for second carrier, Optus Communications. The Melbourne results are expected this month, presuming Optus doesn't call for a second ballot.

Whatever the outcome, late next month will also see plenty of US-style razzmatazz as Optus rains $10,000 in cash on each of 40 lucky punters who participated in the Canberra, Sydney and Melbourne ballots.

According to (now former) Austel Board Member, Johanna Plante, and Telecom's Group Manager, Preselection, Dierdre Mason, Melbourne will likely lean towards Telecom because the corporation employs some 35,000 of its total 70,000 staff there.

"We've looked after them and I'm sure Melbournians, being the kind of football-mad, loyal people they are, will look after us," says Mason. "We didn't expect to do as well in Sydney as we did in the ACT, because Sydney is a bit more entrepreneurial. It's 10 times the size of ACT market and it's a wheeling and dealing, free and casual market which would naturally find the Optus advertising more attractive. But we were comfortable with the ACT result. Losing what we lost was quite a reasonable progression towards a duopoly."

With Brisbane not expected to vote before March next year, Mason says it's too early to make any predictions about the result. "But you have to remember Queenslanders are very loyal to their State and organisations that have helped build it up. We have 12,000 staff in Queensland compared with Optus's 50-odd, so that should have some impact."

"In the long run, Optus' main strengths will be in Sydney and Melbourne. They are not really a general carrier, more a niche player and that will show once you get out of the Golden Triangle of Canberra-Sydney-Melbourne."

The Brisbane ballot is expected to be followed in about July 1994 by Adelaide and Perth, where Dial 1 services start this month.

Telecom's Group Manager, Media, Keith Anderson, says Telecom estimates that every one percent of the market lost to Optus equates to between $40-$45 million dollars. "If we lost 11% nationally — based on the Optus figure in the ACT — you would come up with a figure of between $440-500 million. But because the ballot will continue for 3-4 years, it will be a long time before Optus achieves that kind of market share. There's also the question of how many of the big Government and corporate customers Optus has won and what its true market share is, as distinct from numbers of customers."

Anderson says Optus's ballot successes so far "demonstrate the generous nature of the environment for a new entrant." But he says Telecom will "try to give those 11% every possible encouragement to switch back to Telecom."

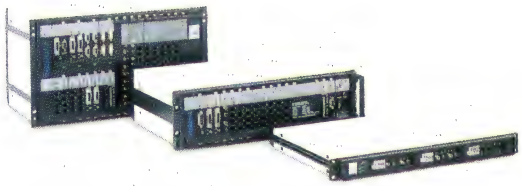
A Ballot Review

Comparing Optus' 11% result in the ACT with new market entrants overseas, Johanna Plante looks to the UK and US experiences. "MCI and others started out without equal access (to the public network) but after new legislation in 1984, things started to change from about 1986," she says. "It's taken British Telecom competitor, Mercury, a decade to achieve the sort of result Optus has managed in just nine months. My understanding is that Mercury has yet to achieve 10% of the market."

Plante says Austel will conduct a review of the ballot process after the Melbourne vote, involving the carriers, ballot administrator Price Waterhouse Urwick and all other organisations associated with the preselection process.

"We may choose to modify the ballot, but we won't be changing it substantially. We'll wait and see what lessons there are for the remaining ballots around the country."

Bernard Levy



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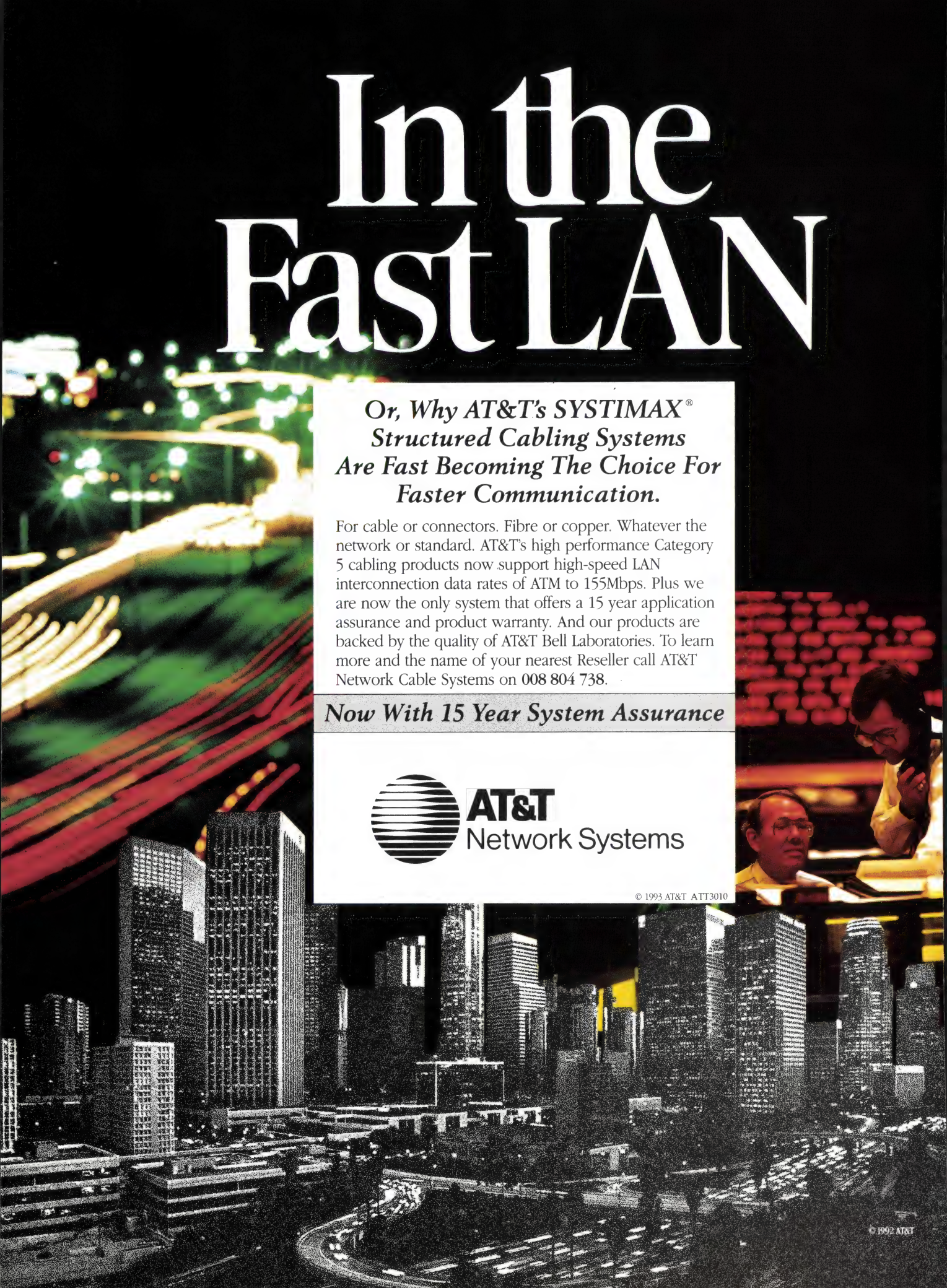
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Satellites

The New Star Wars

Ronald Reagan's Star Wars dream officially died this year with a very public admission that some of the scientists had faked the tests which convinced the US Congress to fund the multi-billion dollar exercise. But there's a much less publicised war going on up there in space between rival satellite owners and new consortia. It is largely being kept under wraps — as a gentle battle between gentlemen — albeit with a bit of eye-gouging and groin-grabbing going on in the scrums. No one really is quite sure who, or what organisation, has legal jurisdiction over space; so there's no obvious recourse to an international umpire's decision.

Tonga vs The Rest

Tiny Tonga, the heavies of the heavyweight division when it comes to exploiting loopholes in international legal systems, gained the admiration of the whole Pacific (and most smaller nations around the world) a few years ago by its audacity in claiming seven orbital slots, which, they said, were for a domestic satellite system.

The ITU recognised Tonga's claims, presumably for the same reason that the larger nations recognise Panamanian flags of convenience and accept the Cook Islands as being the Pacific headquarters for international banking and bond-trading. The bigger nations can't afford to be seen as treating small ones inequitably — even when these small nations are clearly exploiting American and European colonial guilt-complexes for no other reason than commercial gain.

I was involved about this time in training Tonga's first government-sponsored video cameraman — for the police force, since they don't have local television. He was clearly being trained as the high-tech guru of the island kingdom, but I needed to explain which end of the instrument to look through and the difference between AC and DC current, so I share doubts (with the rest of the world) that Tonga's seven domestic satellite slots were being reserved for their local TV production or telecommunications industry.

Behind the scenes is an American businessman, Matthew Nilson, who runs the Tongasat organisation which has sub-leased three of the slots to Rimsat, another US company. Rimsat has just purchased the declining 18 months life-span of a senile Russian Gorizont satellite (with 5 C-band, and 1 Ku-band transponders) and it claims to have an agreement for two new ones from Informcosmos. The Russian contract also includes the purchase of four new Express satellites (10 C-band, 2 Ku-bands) to be launched over the next five years — so they say.

At last count, there were four other organisations disputing rights to some of Tongasat's orbital slots, and there's a lot of kicking and shoving going on to settle matters of orbital separation. A few years ago, 5 degrees of separation was held to be necessary for geostationary satellites, and this only allowed room for 72 around the world. By 1986 they had narrowed the separation to 3 degrees and were talking about the possibilities of 1 degree separations, using laser-beams for the uplink.

The laser-beam idea never eventuated, but satellite companies are now co-locating satellites in the same orbital slot — but only when they can clearly separate the uplinks by using different radio frequencies and/or polarisation.

The Indonesian Palapa B1 satellite is a relatively new satellite, and it was not designed to 'harmonise' with the old Tongan Gorizont, so co-location of these two in the slot 134 degrees E, is out of the question — yet each are claiming the slot. Indonesia says that Tongasat is blackmailing them by only vacating the slot on payment of a considerable pile of greenbacks. Indonesia is refusing to pay.

This 134E slot is one of the few remaining vacant regions in the equatorial orbit capable of spreading signals across South East Asia, so its value lies in its ability to compete with AsiaSat 1 and AsiaSat 2 (next year) in beaming C-band television signals across the whole of the Asian subcontinent, from the Middle East to Taiwan.

Indonesia accuses Tonga of 'satellite piracy' — which is a bit rich coming from a satellite owner which spreads its own television signals across many countries in SE Asia without their permission, and in some cases, even expressly against their claims of broadcast sovereignty. It is also a bit rich for Indonesia to claim that Tonga is clearly not using holding slots for 'domestic' purposes, when everyone (including Australia) is doing the same: the days of respecting other nation's rights to control broadcast and telecommunications links into and out of their country have long gone.

Battle for the Pacific

Intelsat has also moved against Tonga's claims for slots in the ITU, as has PanAmSat. But Intelsat is jointly owned by the carrier-cartels of the world, and it has clearly been applying unreasonable 'restraints of trade' which would, in normal circumstances, have had it charged before an international Trade Practices Commission, if one existed.

PanAmSat sees itself as the white knight of free enterprise in telecommunications and broadcasting; the Intelsat-cartel-breaker of the western world. PanAmSat (PAS-1) has been offering alternative services to Intelsat in South America, but so far the carrier cartel has been extremely successful in resisting inroads into its monopoly business. So PanAmSat is now turning its attention to Australia and South Asia.

PanAmSat's PAS-2 (launched in April 1994) will cover Asia, the Pacific Rim and Oceania with C-band beams, and Australia and New Zealand with a special Ku-beam at a level high enough for direct broadcast TV and business communications.

Direct-to-home TV requires, of course, that the homes already be equipped with receiving dishes, so PAS-2 has been matched to the Optus proposals. It is specifically designed to steal the Australian market with TV programming up-lifted directly from Los Angeles, without the encumbrances of Australian content, and such similar nationalistic/cultural 'baggage.'

Orionsat is another private corporation threatening to enter the pan-Pacific market in opposition to Intelsat and PanAmSat. Its current focus is on the Atlantic market, but partners in the alliance include British Aerospace and General Dynamics, plus various Canadian, Japanese and Italian corporations with Chase Manhattan acting as lead banker. They aren't lightweights, by any means, but so far their Pacific region plans seem pretty vague.

Astrosat Corporation of California, is another American company entering the same business (although the evidence of their tangibility is less obvious than with PanAmSat and Orionsat). They have another Pacific satellite proposal claiming a Tongan slot.

This company is currently offering territory franchises in Australia for a 32 channel 'wireless cable' (direct TV) system that will cost viewers $US12 a month for the basic 28 channels, and $US11 each for another four 'special subscription channels' (Pay TV).

Astrosat claims to be using a new IIDCM (Inclined Interval Digital Component Modulation) technique which they say 'transmits one HDTV quality video signal per 1MHz' of bandwidth. Elsewhere in the world of technology it is assumed that High Definition TV needs about 20-to-40MHz of bandwidth — so this either represents an incredible breakthrough or a very clumsy mistake.

Currently there are 16 geostationary communications satellites in our local region, with a total of about 350 transponders. Asia is said to need about 50 to 100 more transponders immediately (because of a shortage of ground infrastructure), and there are between eight and 15 new satellites (with 200 to 350 transponders) set to be launched in the next few years to fill this gap — so there will be quite a few transponders available on the cheap, assuming that current projections are correct.

Television delivery is the main requirement in Asia, with VSAT-based business communications growing strongly. However, digital compression, with the possibilities of cramming four or more digital channels into every transponder, could make the current plans for new satellite transponders redundant. Only time will tell.

Iridium vs Inmarsat

However the proposed global-coverage of telecommunications using low and medium-earth orbiters represents a new development. There are dozens of proposals for LEO, MEO and GEO telephony satellites for the continental US, but only two with global scope. For voice and data telephony only, the battle appears to be between Motorola's Iridium system and Inmarsat's Project 21.

Iridium has now been modified from the original proposal of 37 channels on 77 Low Earth Orbit (LEO) satellites, to 48 channels on 66 satellites, and they have boosted transmission power. Motorola has also introduced a dynamic capacity-allocation scheme which allows channels to be concentrated over densely populated regions, and it has modified the beam pattern to reduce potential interference. Commercial service is still to begin in early 1998, and the Iridium consortia is growing, with some quite respectable names now involved (including Raytheon, Daini Denden & Kyocera, Stet and Sprint Corporation).

Iridium still faces the problem of needing the regulatory authorities of most of the major countries of the world to agree to allow the system to operate over their territory (since it can by-passes their control), and it is also likely that Iridium will be a costly service to operate. It has the high capital costs imposed by a large number of satellites, and the added complexity of using space-switching in the satellites themselves. Motorola says that a handset will cost only about $US3,000 ($4,400), but monthly service fees of $US50 are projected, and a five minute call will cost about $US20.75. Additional costs might then be levied by the nations who are part of the network.

Inmarsat is aiming at lower usage prices with Project 21 (also called Inmarsat-P), although the required investment of $US3 billion in planning and technology development is not much below that estimated for Iridium. The focus of Project 21 is on handheld telephones, but Inmarsat's plans also include mobile fax, data, paging and positioning services.

Despite the problems of constantly diving in and out of the highly ionised Van Allen belt, Inmarsat has now chosen an Intermediate Circular Orbit (ICO) at distances of about 11,000 kms for Project 21. This appears to be the best compromise between the lower numbers of satellites needed (12 to 15 for global coverage) with this intermediate orbit, and the power requirements of further transmission distance over LEO satellites at a few hundred kilometres.

Stewart Fist

Consumer Affairs

COT Cases Turn Up the Heat on Telecom

The network faults which have forced Telecom to cough up hundreds of thousands of dollars in compensation to small business customers have now become a political football for the Federal Opposition — much to the national carrier's embarrassment and chagrin.

Keeping the ball inflated is a group of users who call themselves Casualties of Telecom, or more commonly, COT Cases — numbering a dozen, or dozens, depending on who you believe — some of whom have received compensation ranging from less than $100,000 to $360,000 for losses estimated in the millions. All recipients to date have been required by Telecom to sign confidentiality documents as a condition of settlement.

While the customer complaint/compensation scenario is hardly anything new, the Coalition has seized the moment and is hollering that Telecom should be privatised immediately; this would sharpen up Telecom's act and introduce bottom-line pressure from shareholders to improve performance and avoid costly settlements.

"These sorts of pressures are noticeably absent at present and there's a big question mark over Telecom's accountability to its present shareholder, the Government, and how much the Government knows about Telecom's activities," claims Shadow Communications Minister, Senator Richard Alston, now back on the circuit after Warwick Smith's demise at the March election.

"Perhaps Telecom is too busy with corporate activities like investing $60 million in Channel 7 and getting involved in interactive television and audiotext services, not to mention multimedia services, like Pay TV, with News Limited and Kerry Packer," Alston says. "Then there's Telecom's push for a stake in Clear Communications in New Zealand and its bid for the British Government network. Telecom has raised $100 million in capital indexed bonds on the Australian market as well as $450 million from US institutions. Perhaps it's lost its primary focus on the local market."

Alston is working closely with the National Party Leader in the Senate, Ron Boswell, in pushing for a Senate inquiry on the service quality issue. Both men are reporting to Opposition Senate Leader, Robert Hill, as part of an overall Coalition drive to destabilise the Keating Government.

Drawing parallels with the Optus interconnect complaints against Telecom earlier this year, Senator Boswell says: "We are trying to establish how widespread the problems are before seeking the support of the Greens and the Democrats for a Senate inquiry. Some of the COT Cases have been offered compensation, but this appears to have been inadequate. I have had people come to me and say they have lost their businesses this way."

Austel's Baby Now

A recent Austel report, eagerly seized upon by Senator Alston, does not paint a flattering picture, noting that Telecom's quality of service to residential customers has declined sharply. Covering the September-December, 1992, period, the report says more long distance calls are being lost; there are more delays in fixing faults in country areas while complaints are generally on the increase. Significantly, Austel questions whether competition and staff cuts may be responsible for the decline in service quality, particularly in rural areas.

After organising two COT Case meetings in Brisbane recently, Austel plans to contact customers from around the country as part of an on-going inquiry. "The inquiry will embrace persons other that the COT Cases and a report will be released as soon as is humanly possible," according to an Austel spokesperson. "There will be no burying of the evidence."

Also present at the Brisbane meetings were Telecom's Corporate Secretary, Jim Holmes and Customer Service Manager, Commercial, in Brisbane, Graham Powles.

Among those with grievances were a vehicle spare parts company and the former proprietor of the Tivoli Theatre Restaurant, who asserts Telecom gave her only a fraction of the $4 million she claims to have lost through exchange faults.

Other 'hot spots' around the country include the northern suburbs of Melbourne, the western districts of Victoria, various exchanges in South Australia, the NSW-Victorian border, Queensland's Darling Downs and other pockets of all seven states.

Some of the most scorching criticism is from COT Case activist Graham Schorer, a principal of Melbourne-based courier service, Golden Messenger, who claims that network faults, on a national basis, are costing Australia's 8-9 million subscribers at least an extra $10 a year each.

Schorer, who maintains a ledger of complaints and correspondence with Telecom some 20 centimetres thick, says he first became wary of Telecom in 1985 when his business telephone system was constantly plagued with faults.

Schorer alleges that at Fortitude Valley and other sites, Telecom does not maintain the exchange batteries properly and this leads to low voltages during peak traffic periods. Up to 60 customers have been affected in Fortitude Valley and a similar number in North Melbourne, Schorer asserts.

"All exchanges run on DC power and when it gets low, what you'll find is that

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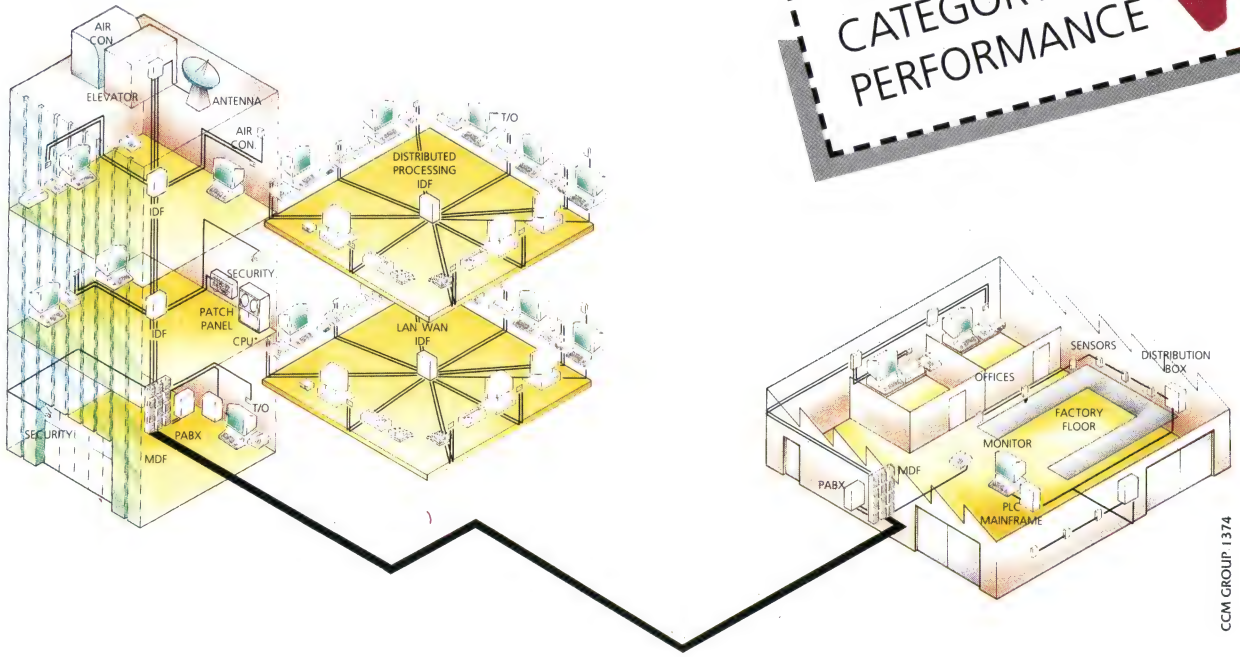

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people the furthest distance along the wire are the first to be affected. The lower voltage also stuffs up the way the computers handle random access selection, especially where there has been a modification to the older ARF exchanges to upgrade them to ARE," he says.

"It's like taking a 1959 Cortina, removing the old engine, then screwing in a 1500cc turbo-charged Formula One motor. You'd have to wonder why things break and go wrong. Telecom publicly denies any problem yet its own internal documents say the opposite. By the time you wake up, you have no money and no evidence. It's hard to go to court," he says.

Amid rumblings about Telecom hounding out staff whistleblowers and making their lives miserable, Richard Alston claims Telecom is playing tough to protect its image. "What amazes me is the extent to which Telecom is prepared to buy these people off," Alston says. "Typically, Telecom says there's nothing wrong with the system but then they shell out $360,000 to a customer."

Spitting the Dummy

Telecom Office of Consumer Affairs spokesman, Greg Newbold, while refusing to divulge details of the compensation pay-outs, says the actual number of aggrieved customers is in the order of a dozen and the Opposition is simply exploiting the situation to score points against the Government.

"We're not saying we have a perfect network. But given the increasing sophistication and complexity of Telecom services in the small business arena, it's imperative we deal with these on a one-to-one basis," Newbold says. "We've spent thousands of man-hours testing and monitoring the exchanges in question and you don't pay compensation when you don't find the alleged faults."

Pointing to Telecom's $11 billion revenues and the $900 million delivered to the Government last year, Newbold says: "One of the misconceptions is that we're making money out of all this. The truth is we'd be making more if we could get on with offering customers even more services rather than spending time fixing faults and dealing with these sorts of compensation cases."

Bernard Levy

Israel

A Land of Promise for LANs and Internetworking

The tigers of the Pacific Rim may prowl the PC industry, but the cat to watch in the LAN and internetworking markets is a young lion in the Middle Eastern desert.

Starting virtually from scratch five years ago, Israel has become a leading supplier of LAN and internetworking gear in the world market. Israeli companies have a long way to go to catch US-based vendors, which now account for about 85% of all LAN and internetworking sales, but with revenues expected to reach $440 million this year — over 4% of the $10 billion in worldwide sales by some projections — Israel arguably can lay claim to the number three spot among internetworking exporters. In some market segments, such as the IBM 3270 and 5250 communications and peripherals businesses, Israeli companies account for 10 to 20% of the world market. That kind of performance is not too shabby for a nation thousands of miles away from its principal export markets and virtually surrounded by hostile states that won't even recognise its existence.

Israel is now home to more than 20 internetworking vendors. Some are general telecom suppliers, such as Tadiran Telecommunications, a $350 million company, and ECI Telecom, a $235 million maker of Synchronous Digital Hierarchy (SDH) and Synchronous Optical Network (Sonet) multiplexers and cross-connect switches. But others are intently focused on Token Ring and IBM communications products.

The amazing performance of Israel's networking companies has not escaped the notice of venture capitalists. Wall Street investment firms are engaging in a "feeding frenzy" to fund Israeli technology companies, reports Daniel Chertoff, an Israeli-based managing director of New York-based brokerage firm Furman Selz. Over the last 18 months, three Israeli networking companies have gone public and are now traded on the US NASDAQ exchange: hub makers Lannet Data Communications and Lanoptics, and Gilat Communications Systems, which supplies two-way VSAT equipment.

Israel's emergence as a hotbed of internetworking activity can be attributed to a number of intertwined factors and developments. One obvious key is the tremendous level of financial help offered to startup firms by the Israeli government. The government's influence reaches beyond finances: Many of Israel's networking entrepreneurs have gained valuable electronics engineering experience serving mandatory stints in the country's armed forces. Israel's focus on nurturing entrepreneurial enterprises is almost a perfect match for the internetworking business, which continues to be driven by smaller, creative companies.

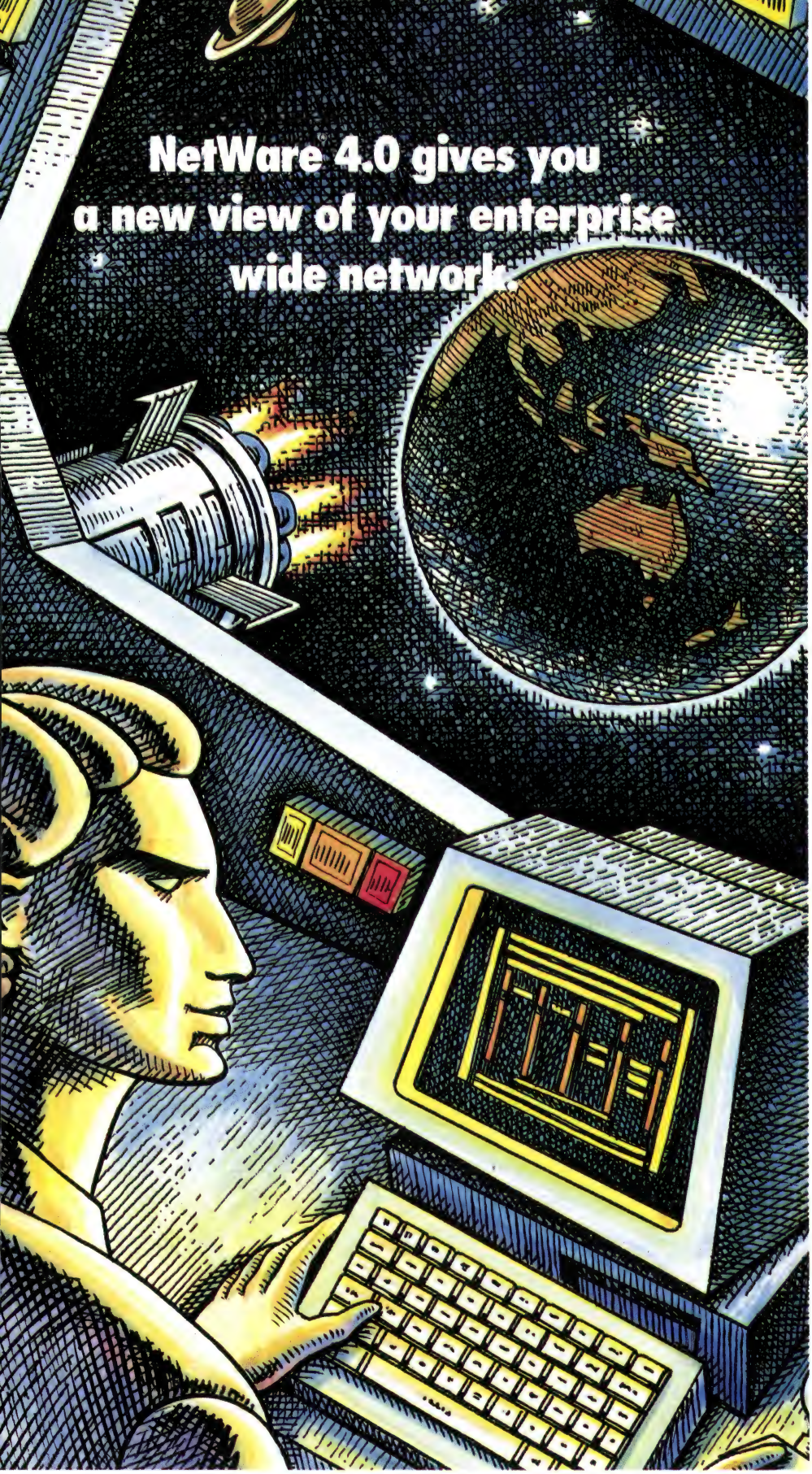
Israeli internetworking firms also are blessed with an ample pool of engineering talent that has been replenished by the arrival of thousands of degree-holding Russian immigrants since 1989. The talent surplus not only helps to keep labour costs low but also has spawned a healthy sense of competition among engineering entrepreneurs, many of whom earned their degrees from Israel's leading engineering school and served together in the armed forces. The competition is heightened by the fact that several leading technology vendors have adopted the strategy of entering new market segments by spinning off subsidiaries that act independently of one another.

Unlike countries like Australia, where venture capital and seed money are hard to come by, Israel is an entrepreneurial paradise. The reason is a series of extraordinary government programs put in place to help new manufacturers that export products. One agency, the Office of the Chief Scientist (OCS), offers startups research and development grants of up to 50% of their R&D costs. The companies then pay back the grants in annual installments of 2 to 3% when profits from the funded products start coming in. Last year, OCS distributed just over $220 million in grants, with 27% of that total going to telecom and data comm companies.

For networking companies, OCS grants represent an attractive source of R&D funding. Back in 1989, Intelligent Information Systems (IIS), a maker of IBM-compatible display units and communications controllers, spent about $1.7 million on R&D — almost half that spending was funded by the OCS. As the company has grown, the level of OCS funding available to IIS has declined only slightly.

Another R&D funding source is the Israel/US Bi-National Research & Development Foundation (Bird-F), which funds joint Israeli-American product development. One Bird-F grant helped finance a joint venture between Lannet and US vendor Chipcom to develop synchronous Ethernet technology that provides superior fault detection and backup, and allows flexible configuration of multiple LAN segments without the need for bridges. Lannet's net 1991 R&D expenditure of $3.2 million was offset by OCS and Bird-F grants totalling $1 million. Fibronics, an FDDI hub and internetworking vendor with manufacturing facilities in both Haifa and the US, received more than $2.9 million in Bird-F grants each year from 1989 to 1991 — about 25% of the company's total R&D expenditures over the three years.

Government programs to nurture fledgling businesses don't end with R&D funding. The Israeli government's approved Enterprise Program offers companies tax breaks ranging from partial reductions to full tax relief for up to 10 years. The program is particularly beneficial to export-oriented manufacturers that set up shop in certain regions of the country. Under this program, for example, Lannet will operate tax-free until at least 1994.



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The Israeli government also offers exchange-rate insurance to protect companies from losses due to currency fluctuations. In the first nine months of 1992, Lanoptics received more than $190,000 in exchange-rate insurance from the Israeli government.

The Military Connection

Many heads of Israeli networking companies have two things in common: they have an engineering degree from the Technion-Israel Institute of Technology, and they have held an electronics-oriented military position in the Israeli Defense Forces (IDF).

All adult male permanent residents of Israel under the age of 51 are required to perform up to 45 days of military reserve duty annually; unmarried adult females up to age 38 may be required to perform up to 30 days duty each year. Reservists also are subject to being called to active duty in emergencies. Instead of pulling guard duty, engineers typically are directed into sensitive posts involving military electronics and communications, where they get to hone skills and receive practical technical training.

The military link to Israel's networking business isn't hard to spot. Shlomo Tirosh, co-founder of Gilat, earned the Israel Defense Award for his IDF research and development work. (Tirosh won't say what the award was for — it's a military secret.) Zohar Zisapel, who with his brother Yahuda founded the RAD Group, Israel's largest internetworking vendor, headed the Electronics Research Department in the Israeli Ministry of Defense from 1978 to 1982. Benny Hanigal, president of Lannet, was the avionics project manager for the Lavi jet aircraft.

Why Internetworking?

Given the combination of top-notch technical training and pro-business government policies, it's no surprise that Israel would serve as fertile ground for high-technology companies. But why have so many outfits entered the LAN and internetworking markets? Most of the reasons are rooted in simple pragmatism. Because the internetworking business is relatively new, it favours smaller, creative companies that can act on new technologies faster than industry giants.

Market realities also steered Israeli LAN vendors toward Token Ring products. By the late 1980s, the market was overcrowded with Ethernet vendors, says David Sinigaglia, Vice President of North Hills, which sells Token Ring products. Sinigaglia adds that profit margins for Token Ring products simply were better than for Ethernet gear.

To Zohar Zisapel, the internetworking and data communications industries are a natural fit for the way Israeli approach to life. "Israelis are by nature a very adaptive people," he observes. "In data communications, you have a lot of change, fast product cycles, and constant development." Israeli engineers are interested in solving problems quickly and creatively, and then moving on to the next challenge, without wasting time perfecting every aspect of a product, he says.

A competitive spirit has also helped Israeli internetworking vendors become a force to be reckoned with on the world market. Of course, the failure of other international vendors to join the internetworking battle hasn't hurt their progress. European vendors with few exceptions took a rain check on the internetworking revolution. The Japanese, for the most part, aren't exporting their internetworking products, and Taiwanese manufacturers are only now expanding from PC components and LANs to higher-end LAN interconnect products.

Among the most interesting new products coming out of Israel is an offering from Netwiz, which is 51% owned by IIS. Netwiz says it will soon begin shipping the TurboSwitch 2000, which the vendor claims is the first hub to provide full LAN-per-port switching for both Ethernet and Token Ring LANs. The key innovation is Netwiz's switch processor module, which provides for parallel data transfers between connected ports by processing multiple Token Ring or Ethernet packets simultaneously. The switch reads the destination address and switches the packet on the fly to its destination port. This switch processor module can handle 60 parallel Ethernet or Token Ring links between connected rings.

Russian Dolls

Some of the creative spark for this kind of innovation is coming from what used to be the Soviet Union. Since 1989, more than 400,000 Russian Jews have emigrated to Israel. Among that group is prime engineering talent; in 1990, 25% of Russian Jews coming to Israel had engineering degrees.

The influx of Russian talent complements an already productive system for nurturing technical and entrepreneurial expertise. Israel is home to several R&D centres that are doing for the country today what organisations like the Palo Alto Research Centre (PARC) have accomplished in the US.

The rosters of top executives in Israeli networking companies represent a kind of entrepreneurial interlocking directorate. For example, Eli Fructer, General Manager of Lanoptics, was Manager of R&D for Fibronics in the early 1980s. He left Fibronics in 1985 to found Adacom Technologies, a maker of IBM 3270 and 5250 products. Fructer served as R&D manager at Adacom until 1989, when he and Eli Harry, Adacom's vice president of international sales, left the company to form Lanoptics.

The RAD Group, Israel's largest LAN and internetworking vendor, has taken this cross-pollination a step further, building its holdings by funding entrepreneurial spin-offs. The company, which rang up revenues of about $154 million last year, has three main divisions: Lannet, RAD Data communications Ltd. (which makes modems, multiplexers, and internetworking equipment), and RAD Network Devices.

Along with these primary divisions, the RAD Group has an increasing number of smaller spin-offs in vertical market segments. RIT Technologies, a 1990 RAD startup, makes cabling systems and components. RADlinx, a 1992 startup, sells gateway products, and RADcom sells WAN protocol analysers. Silicon Connectivity Solutions, which started out in 1987 as an integrated circuit maker, has branched into laptop LAN adaptors. Other RAD startups include RADway, which is focusing on high-speed LANs and channel-extension products, Armon, which is targeting remote LAN monitoring devices, and RADvision, a new videoconferencing startup.

The RAD Group provides its startups with office space, access to a worldwide dealership channel, and manufacturing facilities. It's up to the executives who run the startups to make their idea work.

A recent spate of initial public offerings is one sign that Israel's networking business is maturing. While Israeli companies certainly can use the public funding to expand distribution channels and increase marketing in Europe and the US, they also see going public as a way to earn respect in the world market. As publicly traded entities, Israeli companies expect to be taken even more seriously by large customers around the world.

Israeli firms also are starting to grow by acquisition. In 1990, IIS bought Lee Data, a US maker of IBM products. Adacom bought Harris Corp.'s IBM business in 1990. An Adacom subsidiary, ACE Communications, recently signed an agreement to purchase North Hills from the Porta Group.

Among other small and growing networking companies in this field are hub maker Gambit Computer Communications; Galcom Networking, which makes IBM communications equipment; Better On-line Solutions, which makes PC-to-host gateways; Nice Systems, which manufacturers bridge and router switches; and BATM, a wiring and patch panel vendor.

Most of these companies sell products that are less than leading edge — IBM system/3X and 3270 peripherals, Token Ring LANs, wiring hubs, and the like. Joseph Adir, President of Galcom, suggests that higher-echelon products are on the way, including ATM switches. Many of the world's leading semiconductor companies, including Intel, Motorola, and National Semiconductor, have made major investments in Israel in recent years, giving Israeli engineers the chance to develop leading-edge silicon that is driving the entire computer and communications industry. It may not be long before this is translated into technology leadership in networking.

Joseph Braue

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Multimedia Choices: The Three Faces of FDDI

Can FDDI networks handle multimedia applications? It all depends on which FDDI users have in mind.

Debates about high-speed networking options typically boil down to two choices: FDDI now, or ATM later. The reasoning is that organisations with an immediate need for more bandwidth can go with 100Mbps FDDI, a proven entity that's available now, while those that can afford to wait can hold off for ATM, which promises to be the more powerful and versatile option.

The implied message in this rationale — one that has FDDI vendors very worried — is that FDDI is a stopgap until ATM comes along. Aside from about 50Mbps of extra bandwidth, the main advantage ATM holds over FDDI is its ability to handle time-sensitive traffic like voice and video — the kind of traffic that will be a big part of the interactive multimedia applications expected to sweep through corporate networks in the coming years.

FDDI vendors are hoping to counteract ATM's multimedia advantage — and thereby stretch FDDI's life span — by making FDDI more suitable for carrying voice and video. So far, their efforts have yielded three alternative strategies (see table). One is to continue using the original, asynchronous FDDI networks, either to carry non-interactive multimedia applications along with other data or to handle time-sensitive traffic by severely restricting async traffic volumes. A second option is to extend the existing FDDI standard to give what amounts to special priority to synchronous traffic. The third strategy involves hammering out a completely new standard based on a different network architecture.

To this point, each approach has won lip-service approval from a variety of vendors, but developers have been slow to act on their words. Only one vendor has released a synchronous FDDI product, while a draft version of the new FDDI standard, called FDDI II, isn't expected to be completed until later this year. To complicate matters further, the ANSI committee that developed the original FDDI spec is now working on a new gigabit-speed version of FDDI, called FFOL (for FDDI Follow On LAN). Although FFOL is undoubtedly years away from completion, its drawing board existence may make it harder for the emerging options to succeed. This is especially true for FDDI II, which despite its name is completely incompatible with installed FDDI gear and will require users to invest in new equipment.

Standing Pat

FDDI vendors can make a strong case for their products when it comes to immediate bandwidth gratification. After all, for all the glowing reports about ATM, the technology still is unproven in the real world. FDDI is a stable standard, with more than 80 products now on the market. Those products can be had for about one-fifth the price of equivalent ATM offerings.

Those advantages sound great until users start to look a year or two down the road, when ATM and multimedia products are likely to begin appearing in bulk. The original FDDI standard covers asynchronous data networks; ATM is being built from the ground up to handle voice, video, and data. Multimedia applications that involve interactive voice and video communications will require networks that can guarantee timely delivery of that traffic. Asynchronous FDDI can't meet that guarantee.

It's important to note that not all multimedia applications are interactive. Multimedia features like voice annotation of text files or access to stored motion video or still images can be handled asynchronously, like any other data file. In such cases, receiving stations wait until the whole file has been received before displaying it. Network delays don't affect the quality of these applications, which means asynchronous FDDI can handle them. "FDDI is a very good medium for non-interactive applications," says Hal Spurney, European Managing Director for Fibronics International, an FDDI vendor.

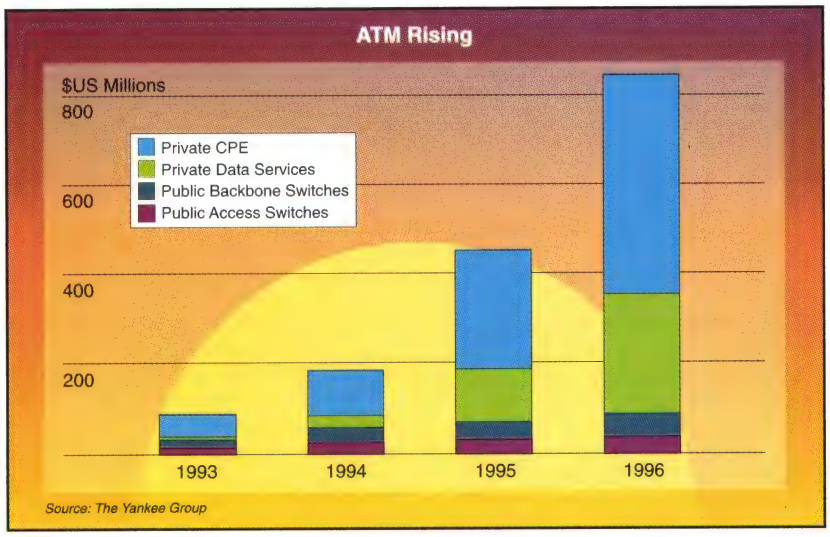
Some FDDI vendors assert that FDDI's 100Mbps of bandwidth is enough to make sure that time-sensitive, real-time applications arrive on time. "We have demonstrated the ability to run multimedia over FDDI, so we question the need to implement synchronous FDDI or FDDI II at all," says Karl Peiperm, FDDI Program Manager at Digital Equipment Corporation. A DEC product called DECspin lets users run up to six simultaneous two-way full-motion videoconferences over regular FDDI.

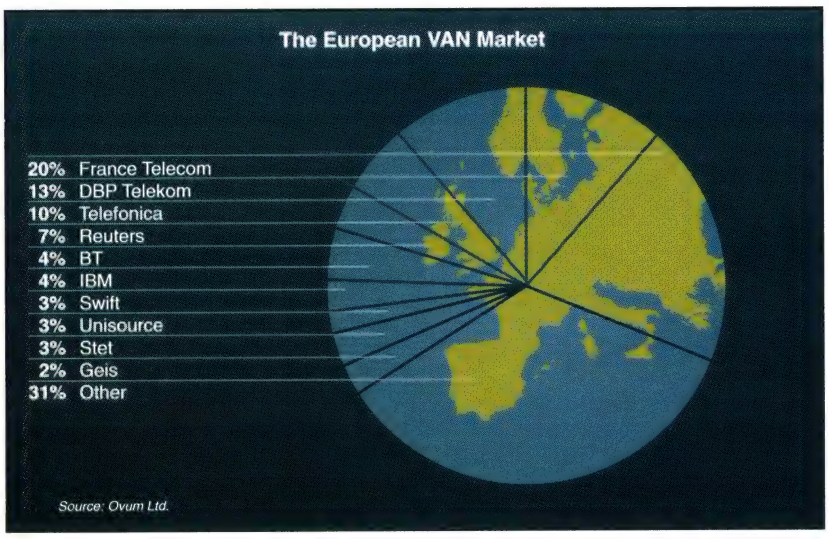
But anyone who uses asynchronous FDDI for interactive multimedia applica-

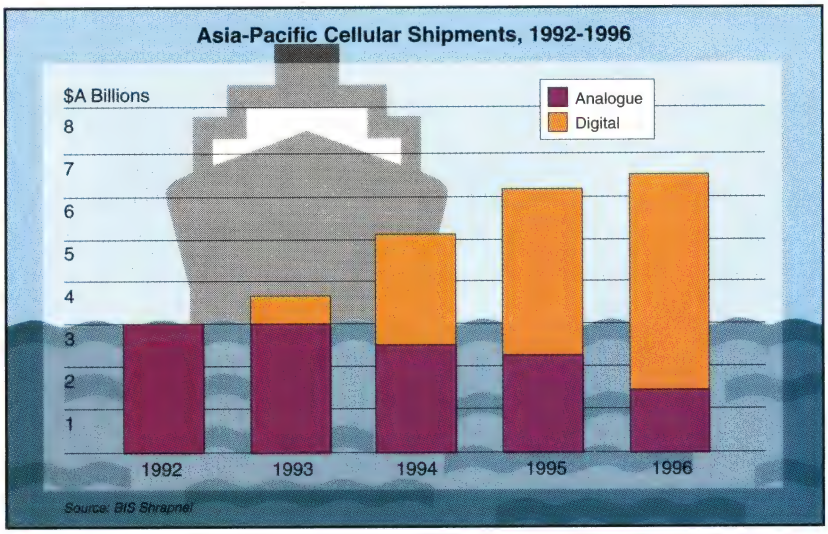
The FDDI Difference

TECHNOLOGY	STATUS	ARCHITECTURE	COMPATIBLE WITH INSTALLED FDDI	AVERAGE NODE-TO-NODE NETWORK DELAY	MULTIMEDIA CAPABILITY
Asynchronous FDDI	Ratified	Token Passing	Yes	10 to 200 milliseconds	Does not prioritise traffic, which means time-sensitive applications suffer as the network gets busy
Synchronous FDDI	Ratified	Token Passing	Yes	8 to 16 milliseconds	Allows time-sensitive traffic to be prioritised, providing a more efficient medium for carrying multimedia applications than asynchronous FDDI
FDDI II	Draft version scheduled for Q4 1993	Circuit-Based	No	125 microseconds	A circuit-based architecture provides a higher quality vehicle for multimedia applications than either asynchronous or synchronous FDDI

Market Watch







tions has to keep in mind one major caveat: if the network gets congested, the quality of delay-sensitive voice and video traffic will fall through the floor. Asynchronous FDDI uses a token-passing scheme to send traffic along the network. A token travels around the FDDI ring, stopping at each station to give it the chance to transmit frames. Timers built into FDDI adaptors measure how quickly the token is passed around the ring. If the token-passing speed falls below a predetermined level, the adaptors assume the network is congested and return the token to the ring without transmitting, causing traffic delay. The delay doesn't have much of an effect on asynchronous traffic, but it can wreak havoc with isochronous traffic like video and voice.

To alleviate this problem, video cards installed in desktop PCs to support multimedia applications can capture video and voice frames as they come off the network, buffer them in memory, and then reassemble them and pass them to the PC in a continuous stream. This approach can salvage the quality of interactive video and voice transmissions, but it detracts from the real-time nature of applications like desktop videoconferencing by introducing delays between sending and receiving stations. One way to get around this drawback is to limit the number of devices transmitting asynchronous data on the network to ensure that multimedia traffic doesn't get squeezed out. But that's not always practical, and it certainly isn't ideal.

Synchronicity to the Rescue

Despite the assertions of vendors like DEC, network managers probably will feel more comfortable implementing a version of FDDI that supports prioritised traffic. Some FDDI vendors are working on a way to implement a feature included in the original version of the FDDI standard to do just that. The feature allows traffic to be prioritised, thereby dedicating bandwidth to isochronous voice and video traffic.

This approach, known as synchronous FDDI, uses a variation of the token-passing access mechanism. In essence, stations handling delay-sensitive traffic are segregated from those handling asynchronous data. This is done by configuring the network to apportion a given amount of bandwidth for synchronous communications only. The token timers in the asynchronous stations are configured to assume that bandwidth dedicated to synchronous stations has already been used up. Thus, synchronous stations are always able to transmit data up to their specified bandwidth limit.

For instance, in a network with 40 stations running time-sensitive applications and 80 stations running asynchronous data applications like file transfer and database access, the network administrator could dedicate 2Mbps of bandwidth to each syn-

chronous station, leaving the asynchronous stations to share the remaining 20Mbps. If a synchronous station does not need all of its reserved bandwidth, it just returns the token to the network early, making the remainder of its dedicated bandwidth available to asynchronous stations for the rest of that token circuit.

Due to the fact that synchronous FDDI adaptors obtain bandwidth using a modified version of FDDI token-passing facilities, they should interoperate with installed asynchronous products. It's worth noting, however, that no independent interoperability testing has taken place between synchronous and asynchronous products.

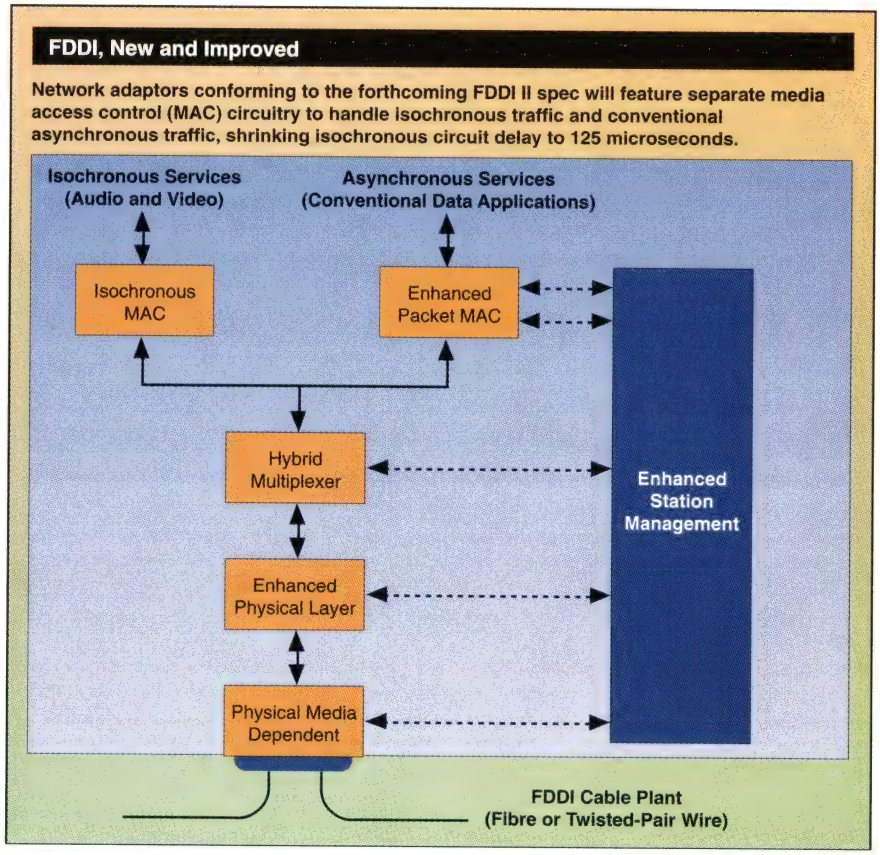
ANSI's X3T9.5 committee is now working on an addendum to the SMT (station management) part of the FDDI standard that will define a procedure for allocating synchronous bandwidth to network stations.

The purpose of the addendum is to eliminate potential problems that are inherent to synchronous FDDI, such as the risk of overallocating synchronous bandwidth to the exclusion of asynchronous stations on the network. A draft version should be ready later in the year. In the meantime, it is at least unlikely that synchronous FDDI adaptors from different vendors will be able to interoperate.

Because synchronous FDDI is part of the original FDDI standard, some users will be able to field-upgrade their asynchronous FDDI adaptors via software. Others won't be so lucky, and will have to resort either to sending their cards back to the manufacturer or buying new ones altogether. "If the adaptor vendor hasn't built enough memory into its board to service both the synchronous and asynchronous traffic queues, the adaptor can't be upgraded in software," says Mike Wentz, Vice President of technology at Syskonnect.

Syskonnect claims a synchronous FDDI software upgrade will be available for its FDDI adaptors this year. Likewise, Crescendo Communications, Interphase, and 3Com all say their asynchronous FDDI adaptors can be software-upgraded to handle synchronous FDDI. But adaptors from Network Peripherals, Rockwell International, CMC Network Products, and Synernetics will require changes in hardware.

Despite all the positive noise about synchronous FDDI, not much has happened on the product front to this point. Only one vendor, a US-based startup called Alfa Incorporated, is now shipping synchronous FDDI products. However, the trail being blazed by Alfa is certain to be followed by others in the FDDI fraternity should the predicted market for multimedia applications materialise. Some 16 vendors have joined the Synchronous FDDI Forum, a vendor body set up to examine the potential of synchronous FDDI. All FDDI vendors contacted for this article say they have plans to implement synchronous FDDI products, once a significant market develops. "The key thing to note is that there is no demand for either synchronous FDDI or FDDI II at the moment," says George Prodan, high-speed product line manager at 3Com.



A New Direction

One possible reason for the initial reluctance of vendors to embrace the synchronous FDDI approach is the anticipated arrival of FDDI II, a completely new FDDI standard that promises dramatic improvement in the way isochronous signals are handled. Instead of token passing, FDDI II will be based on a circuit-switching architecture (see figure). Proponents say circuit switching will trim the average node-to-node network delay to 125 microseconds — 1/64th the delay for synchronous FDDI.

FDDI II uses a multiplexing technique to divide FDDI's 100Mbps bandwidth into 16 separate 6.144Mbps circuits, each of which can be allocated to carrying asynchronous data or isochronous traffic. Each of the 16 circuits is in turn subdivided into 96 separate 64Kbps channels.

By carrying traffic in channels, FDDI II can guarantee a fixed delivery time for multimedia traffic. In contrast, the delays on asynchronous and synchronous FDDI fluctuate depending on the amount of traffic on the network. Even though video card buffering can alleviate some of this problem with FDDI, applications benefit from the predictability of FDDI II.

By keeping delays down, FDDI II also reduces the chance that multimedia applications will encounter problems with quality when run over WAN internetworks, where bridges or routers, and the time taken for traffic to traverse the wide-area connection itself, add to the amount of network delay. Because FDDI II carries multimedia information in 64Kbps channels, traffic from the FDDI II network can be passed to the WAN without requiring users to install equipment that can adapt to the speed and clocking cycle of the traffic streams. An interactive videoconference that requires two 64Kbps channels can be transmitted from the FDDI LAN to the WAN with little problem.

Problems Ahead

Despite its superior ability to handle isochronous traffic, FDDI II may have a hard time attracting widespread support from users or vendors for two reasons. The first is that, unlike synchronous FDDI, FDDI II is incompatible with current FDDI products. To implement FDDI II, users will have to trash their older FDDI adaptors.

FDDI II's second immediate disadvantage is cost. Adaptors that comply with the new standard will have to be equipped with a MAC (media access control) chip for asynchronous traffic, and another one for isochronous traffic. They also will need a multiplexing component that can mix the two different types of traffic onto the same backbone. The additional components will add about 10% to the cost of an adaptor,

estimates Jayshree Ullal, Vice President of marketing at Crescendo Communications.

The lack of downward compatibility and the potentially higher costs have kept FDDI II from getting a cork-popping welcome from the networking industry. One of the three major silicon vendors that make FDDI chip sets — National Semiconductor — is planning to implement FDDI II. And only one vendor has committed to producing FDDI II products. Australia's AWA Defence Industries plans to launch an FDDI II product line, called AWAnet-100, next April.

FDDI II does have one significant endorsement to its credit, however: IBM. Sources within the company are painting an optimistic picture for the emerging standard. "We believe FDDI II will be a premier solution for multimedia requirements," says Dennis Kalajainen, advanced networking solutions advisory engineer at IBM's facilities in Manassas, Virginia.

The ATM Challenge

While most networking vendors are holding back on synchronous FDDI and FDDI II, they aren't being shy about unveiling their plans for ATM products. ATM networks can carry multimedia applications with even less delay than FDDI II because ATM's fixed-size 53-byte cells can be processed more quickly than the variable-size frames (up to 4.5Kbytes) used in FDDI.

But FDDI does have some advantages over ATM. One is that FDDI makes more efficient use of bandwidth. Each 53-byte ATM cell has 5 bytes of header information, representing a network overhead of about 10%. FDDI frame headers are 14 bytes long; for 4.5Kbyte frames, that represents an overhead of 0.3 per cent.

Another FDDI advantage is price where recent cuts by vendors and projected advances in chip design in the near future mean that FDDI will be a much more cost effective solution than ATM for some time to come. Of course, ATM prices should start falling once production levels pick up.

FFOL to Follow

If three kinds of FDDI aren't enough, users can look forward to yet another version. FFOL, now being worked on by ANSI's X3T9.5 committee, will define an ultra high-speed fibre network to handle isochronous and asynchronous traffic simultaneously. No firm decision has been made on how fast FFOL will run, although speeds in excess of 2Gbps are being considered.

The wait for FFOL will be a long one, however. "Work on FFOL is mired down because it lacks a technology champion to push its development," says Gordon Stitt, Vice President of marketing at Network Peripherals. New products based on FFOL are still some years away, he adds.

Stephen Saunders

Category 5 Cabling Revisited

Figure 2 in 'Category 5 — What Are You' in last month's edition contained an inconsistency. The corrected table appears below.

	Maximum Attenuation dB per 305 metres			NEXT Loss Worst Pair dB @ 305 metres		
Frequency (MHz)	Category 3	Category 4	Category 5	Category 3	Category 4	Category 5
0.064	2.8	2.3	2.2	-	-	-
0.150	-	-	-	54	68	74
0.256	4.0	3.4	3.2	-	-	-
0.512	5.6	4.6	4.5	-	-	-
0.772	6.8	5.7	5.5	43	58	64
1.0	7.8	6.5	6.3	41	56	62
4.0	17	13	13	32	47	53
8.0	26	19	18	28	42	48
10.0	30	22	20	26	41	47
16.0	40	27	25	23	38	44
20.0	-	31	28	-	36	42
25.0	-	-	32	-	-	41
31.25	-	-	36	-	-	40
62.5	-	-	52	-	-	35
100	-	-	67	-	-	32

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Asynchronous Transfer Mode

Telecom Signals ATM Start

Asynchronous Transfer Mode (ATM) in the public network represents a sea-change in telecommunications. We've all been watching the developments for many years now, and it has always seemed to be a technology of the distant future. But suddenly ATM has arrived — both in LANs and in Australia's national telecommunications network.

Telecom Australia has announced that it will introduce an experimental ATM network towards the end of next year, with switches in Sydney, Melbourne, Canberra and Brisbane. Those in the know say it will support data and isochronous services, but haven't, as yet, got a clue about pricing. A good guess is that tariffs will be matched to the Fastpac rates.

It appears that Telecom will be putting an ATM switch in each of the four eastern capitals and connecting the main links (Sydney/Canberra/Melbourne) by SDH (Synchronous Digital Hierarchy) at 155Mbps — which is the standard STM-1 data rate. The other section (Sydney/Brisbane) will be linked at 34Mbps using the stock-standard PDH (Plesiochronous Digital Hierarchy) inter-exchange transport system. Companies can have access to the mainstream link at up to 130Mbps (provided no one else is using it), and through Brisbane at 30Mbps.

The lower-rate channel to Brisbane appears to have been added as an after-thought to provide links for Defence and Customs. These organisations now have a number of dedicated fibres from Brisbane to Longreach which are being used to transport the millions of bits-a-second of raw data from the Longreach Jindalee over-the-horizon radar back to Brisbane. They are said to be keen to experiment with ATM-type extensions of this flood of data over the main defence network to their key processing centre at the Defence Headquarters in Canberra.

Multiple Interests

Telecom is interested in these ATM trials for three reasons, according to Jim Parks, General Manager of Networks Infrastructure in Research:

- For internal experience in tracking bandwidth requirements of high-speed cell-based networks, and for experience with signalling systems. (Initially CCS#7 signalling carried in ATM cells across virtual circuits will be used.)
- To gain experience with the type of applications that the companies will wish to carry over these networks. Telecom already has multimedia and imaging ap-

Continued on page 43

Technology Update

AT&T Produces Fastest Telecommunications Lasers

Scientists at AT&T Bell Laboratories in the US have produced the world's fastest telecommunications lasers. One type, known as a single-mode laser, emits light at a single wavelength, or colour, and turns on and off 22.5 billion times a second. Another type, called a multimode laser, emits light over several wavelengths and operates at 25 billion cycles per second. The experimental lasers are made of gallium-indium-arsenide-phosphide alloys grown on an indium-phosphide substrate. The company said such lasers could be used in high capacity local distribution of telecommunications and in ultra-high capacity LANs, for distributing data and video images over optical fibre inside a building, or across a campus or city. Single-mode lasers allow transmission up to tens of kilometres, while at ultra-high data rates, multimode lasers are only suitable for short distances, up to a few hundred metres.

Philips Codec Sends CD-Quality Audio Down ISDN

Philips has launched an audio codec that allows CD-quality audio to be relayed down a 2 x 64Kbps ISDN circuit. The company says the product will let broadcasters abandon special leased circuits for relaying transmissions, and permit them to use ordinary basic rate ISDN lines instead. The codec, which compresses 1,400Kbps into the 2 x 64Kbps, is part of a new Philips system called Magic (Multi Audio system with Groupable Interfaces and Codes). The Magic system can also be applied to other digital networks or satellite links, and is able to deliver audio material in analogue or digital format, with added capacity for additional data at rates of up to 5Kbps per stereo channel. (Telecom*europa*)

Another High-Speed LAN Technology

High-speed local area networking technologies such as Fast Ethernet, ATM, fibre channel, FDDI and CDDI will be joined by a new standard by the end of the year, when the IEEE is expected to finish work on its P1394 spec. The new standard defines a limited distance LAN operating at 100, 200 or 400Mbps, and because it specifies low-cost cable connectors and six-pair shielded copper cabling, is expected to produce a range of affordable products. Analysts are predicting the cost to be around a third less than that of FDDI networks, but with a trade-off for distance. Under the standard, devices can be daisy-chained together using up to 32 hops of not greater than 4.5 metres each. New P1394 LANs also will accommodate isochronous traffic, making them well-suited to multimedia applications.

IBM Cautiously Endorses ATM

IBM has announced it plans to roll out an entire line of ATM products by the end of 1994. The products will include chip sets, adaptor cards, a workgroup switching hub, and a new product that the company is calling a Transport Network Node (TNN), which is essentially a high-end ATM switch that is designed for both private networks and public service providers. The announcement comes after a period of only lukewarm enthusiasm for ATM technology from IBM, but does not mean that IBM has suddenly done an about-face. While its other ATM products will use standard ATM interfaces, the new TNN, which is due by the end of 1994 is based on the Paris project and will use variable-length cells inside the switch rather than the 53-byte cells specified by ATM. IBM claims the variable-length packets will save up to 20-50% of recurring bandwidth charges. IBM says it will license its ATM chip set, and will upgrade its 8250 hub to support ATM by the middle of next year.

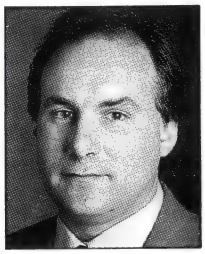
SynOptics, Novell to Develop High-Speed Nets

SynOptics Communications and Novell have signed a Strategic Development Agreement which provides for joint research and development, cooperation in training and customer support, and dedicated on-site Novell engineering support to SynOptics. The companies said the agreement has come in response to customer demand for strategies to migrate current local area and internetworks into next generation LANs that can utilise new switched communications technologies. The companies will work on developing a high-speed computer networking system that will take advantage of technologies such as ATM. They will also examine related 'class of service' capabilities, which automatically assign the bandwidth necessary to support varying transmissions and their throughput requirements.

Now, a Hub That Talks Back

UK-based Pilkington Communications Systems has developed a hub that 'talks,' to help users in remote sites who don't have access to technical staff to solve network problems. When trouble occurs on the network, a user merely pushes a button on the front of the hub, and a voice synthesiser explains what the problem is and what to do about it. The company says voice synthesis lets it use all the diagnostic data generated by the hub, some of which is not able to be shown via the usual front panel lights. The talking diagnostics feature has been popular with users in initial demonstrations in the UK, and the company says it plans to add the option to its smaller hubs by the end of the year.

LAN VIEWS



ATM and the Dead Parrot Sketch

Graeme Le Roux

There are times when I think the only difference between the IT industry and Monty Python's Flying Circus is that the IT industry does not have Terry Gilliam's cartoons to get it from one de-railed train of logic to another. Reading what the industry's marketing machines have to say about Asynchronous Transfer Mode (ATM) is a case in point.

The CCITT began work on ATM with the relatively straightforward intent of providing a standards set for the transmission of integrated services — voice, video and data — requiring varying bandwidths over a single packet switched wide area network. This would allow the world's telcos to install one set of boxes to provide all their packet switched services.

If you are getting a feeling of deja vu at this point, it's because the same things were said about ISDN. The difference is that ISDN is a circuit switched technology. The ATM forum has adapted CCITT's intent for use within campuses and buildings. After all, it would be nice to be able to lay one set of media around your campus or building and run all your voice, data, fax and video — CCTV security cameras, multimedia, cable TV in hotels, etc. — over that one cable plant. Just the sort of application for which broadband technology has been sold for years

The main problem with broadband, which is resolved by ISDN, ATM and other more recent technologies, is that it would be technically difficult and very expensive to implement in a wide area environment. The concept of a broadband exchange would be frightening, although as a method of getting pay TV, telephone and other services down one fibre from a local exchange (ATM, ISDN or otherwise) to your house, it might have possibilities.

The main point to remember about ATM in a campus or building environment is that it is simply another way of delivering several different services via a single cable. At present, vendors are building modules which will allow ATM services to be delivered to hubs, routers, bridges and the like. In other words, you can replace your Ethernet, Token Ring, FDDI, broadband or other type of backbone with ATM.

As far as your users are concerned, ATM means nothing at present. A 10Base-T adaptor connected to a 10Base-T hub is a 10Base-T adaptor connected to a 10Base-T hub, whether the hub is connected to the rest of the world by ATM, FDDI, FOIRL or anything else. The main difference is that the hub is now an ATM switch with a 10Base-T (or whatever) interface.

If you are wondering why you are supposed to be buying ATM for your hubs, the answer is the same as for installing fibre in place of 10Base-5, moving from 10Base-2 to 10Base-T and installing ISDN rather than being totally reliant on point-to-point links; that is, cost efficiency, scalability and 'future proofing.'

The cost efficiency comes from the fact that you will be able to bring high bandwidth to the desktop with nice cheap copper rather then expensive fibre. You see at some later date you can put an ATM switch on each desktop which talks to the switch in what was your hub. This makes the solution scalable (more bandwidth when and where you need it) and future proof (you can keep your old hub). The catch is that the part of your old hub you get to keep is the chassis all the modules slot into — the cheap bit. You also have to install a Category 5 cable system to run those 155Mbps links to the desktop. As those who read 'Category 5 — What Are You?' by Jim O'Sullivan in the September issue of *Australian Communications* will be aware, this entails a good deal more than just installing wire with 'Category 5 capable' printed on the side.

Now, if you accept the need for all this bandwidth at the desktop you might ask yourself why you should go to all the trouble of defining ATM? After all, given that Category 5 cable systems can physically deliver such bandwidth, why not simply 'rev up' Ethernet or some other existing media access method to about 100Mbps? Simple. Remember that the idea of ATM is to combine voice, data, video, etc. on the one cable. In other words, you put an ATM switch in your PC and plug the phone into that (assuming the PC doesn't act as the phone). Later on you can plug in your video phone. To do all that you must have high bandwidth. This neat bit of circular reasoning justifies buying Category 5 cable and ATM-capable boxes, and gives vendors a large number of possibilities for future products, such as ATM adaptors for PCs.

ATM in PCs would also let IT vendors expand their markets. If you have a network transmission system which is capable of switching phone calls why do you need a PABX? I'll just bet that when ATM vendors move on the PABX market the reasons for buying ATM and decommissioning your PABX will be something along the lines of cost efficiency, scalability and 'future proofing.'

The only cloud on the ATM horizon is the unfortunate fact that, as I write, the only part of the ATM standards which are anything but drafts are those dealing with the internals of ATM switches. Nothing regarding the method by which ATM switches are supposed to communicate through physical interfaces has been finally defined.

"ATM has to be a complete standard set. ATM's technology has to mature to a point where it is as reliable as, and cheaper than, current telephone/PABX technology."

Having said all that, I must say that I believe that ATM will eventually present a useful alternative in some cases. I believe that the CCITT's original idea of a high-speed packet switched transmission standard for integrated data is long overdue. I believe that ATM will prove useful as a campus backbone technology. I am still dubious about desktop ATM merging the phone and the PC. I am even more dubious about the departure of the PABX from Australian offices in the near future. I simply do not believe that all the technological pieces are in place at this point.

ATM has to be a complete standard set. ATM's technology has to mature to a point where it is as reliable as, and cheaper than, current telephone/PABX technology. Software has to appear for an integrated environment — Microsoft's Windows Telephony API is still just a spec, and the Microsoft at Work project (does anyone remember the paperless office?) is still a concept.

Above all, users have to be given time to accept the technological change an integrated PC/phone/fax/etc. represents. For the moment, if anyone tries to sell you a pretty new parrot remember to check the perch for nails.

Graeme Le Roux is a Director of Moresdawn Pty Ltd (Bundanoon, NSW) and specialises in local area network consulting services.

TELECOMMUNICATIONS

Write Your Own PABX Programs?

Stephen Coates

From his office, Simon hears Kellie's phone ringing and sees that she's not there. Just as he dials the group call pickup code, Bob's phone in the office next door starts to ring. What happens? Simon picks up Bob's call, Kellie's phone is still ringing and Bob is wondering why his phone rang only once.

Across town, the telecommunications manager of a manufacturing company has a request to enable the telephone sales officers to transfer incoming calls to the warehouse, which is not connected by tie-line. But this presents a problem, as these staff have STD access and allowing this external transfer will allow them to transfer their friends' calls to STD numbers.

Meanwhile in the head office of a computer company, the communications analyst is grappling with a different problem. Many calls on the tie-lines from the development centre are made from modems which are not to use compressed channels on the interstate Megalink. But if access between the two routes is barred in the route-to-route access table, instead of alternate routing to the uncompressed channels, these calls will be blocked.

All of the above are examples of the sort of issues a telecommunications analyst must face from time-to-time. They are all paraphrasings of functional limitations the author has encountered with different PABX types over the years. And they are all limitations not so much with the PABX itself but with its software.

The classical response that may be offered to this type of problem is that it should have been the subject of a tender (although I've yet to find a PABX that would overcome the problem described in the first paragraph) or that a consultant should have been engaged — after all, they know everything.

The root of the problem, however, is that the PABX industry — especially suppliers, but also customers and consultants — treats PABX hardware and PABX software as a single inseparable commodity. But the time is right for suppliers to offer, and customers to demand, that hardware and software be sold separately and supported separately and, more importantly, that customers be able to develop and implement their own PABX software.

Software is still very new to PABX manufacturers, most having sold stored program controlled (SPC) PABXs for only about 15 years, following Rolm's introduction of the CBX (computerised branch exchange), which turned the PABX system market on its head in the mid-1970s. While they have come to terms with soft-

Comparing PABX System Offerings

	ALCATEL BCN 4300	AT&T DEFINITY	FUJITSU 9600	GEC PLESSEY ISDX	NEC 2400 IMS	ERICSSON MD110
Can users write their own PABX software?	No	No	No	No	No	No
Operating system language	6800 assembler	Orox/Pecos (Unix-like)	Chill	Herma	C	Plex-M
Source and object code	Yes	Yes	Yes	Yes	Yes	Yes
Can comments be incorporated in source code?	Yes	Yes	Yes	Yes	Yes	Yes
Can PABX software be emulated on a computer?	No	Not by customers	On M-series mainframe	On DEC VAX	Proprietary info	Proprietary information
Can software be loaded remotely?	Only by diskette	Yes	No	Yes	No	From disk
Can a configuration be loaded on a backup processor, and tested before making this configuration the production configuration?	No	Possible, but not recommended	Yes	Yes	No	No, only one processor per LIM
Software upgrades since PABX introduced in Australia	1	2	5	15	5	11
Of these, number that required hardware upgrades	0	1	0	1	2	Most
Can comments be included within least cost routing tables?	Some	Some	No	No	No	No
Are macros available for least cost routing tables?	No	No	No	No	No	No
Can the abbreviated dialling table incorporate destination names enabling the printout to be the user documentation?	Yes, 16 characters	Yes, at least 30 characters	No	Yes, 21 characters	No	No
Does the supplier offer maintenance of software only as an optional alternative to combined hardware/software maintenance?	No	No	No	Yes	Yes	Yes
Does the supplier offer a combined hardware/software maintenance package that includes free software upgrades?	Under consideration	Yes	No	Yes	No	Under consideration

ware packages (hotel/motel, ACD), patches and upgrades (although the upgrades often require corresponding hardware upgrades), hardware and software are still sold as a single package. Things have been different in the computer industry, though, ever since courts in the US ruled that computer hardware and software had to be priced, sold and supported separately.

Similarly, section 47 of Australia's *Trade Practices Act* prohibits the compulsory bundling of goods and services into a single take-it-or-leave-it package, called 'third line forcing.' To date, though, no one has taken action against a PABX supplier or maintainer through the TPC. Perhaps it's time someone did.

But being able to buy PABX software and PABX software maintenance separately is only the start. Without the means to develop and implement software on their PABXs, customers and third-party software suppliers would derive little benefit from such a separation apart from being able to have in-house staff or a local operator maintain the hardware and the supplier maintain the software.

To be able to develop and implement PABX software, the following are required:

- Separation of system and application software;
- Source code which can be structured and documented, and which can be compiled into object code;
- Source code written in an appropriate language such as C or CCITT standard CHILL or SDL;
- A powerful editor (if PABX suppliers' moves and changes terminal facilities are anything to go by, these are a long way off);
- The facility to emulate software without disrupting the PABX's functioning; and
- The facility to rapidly load software onto the PABX, whether it be local or remote.

The above might appear to be a tall order. But many of these are supported by PABXs today (see table), even if not offered to customers, and those that aren't would, if developed, be used by the PABX manufacturer with its own software development.

Whatever costs might be incurred opening what the suppliers perceive to be the Pandora's Box of letting customers write PABX software, PABX suppliers would do well to consider the following advantages of such a step:

- Customers and software houses planning to develop PABX software will not do so on their live systems and so will buy additional systems for development;
- With customers able to develop features not standard to any system, they will be more inclined to continue to use that PABX instead of switching brands or to a carrier centrex service.

And if this is not a big enough carrot, I don't know what could be. Consider the purchase of computers. Customers generally select an MS-DOS PC, an IBM mainframe with MVS, a DEC VAX or whatever, not for their intrinsic features, but because they need that particular machine to run the chosen application software. If any one PABX system enabled customers to execute any one of a suite of PABX applications, these software products would sell the PABX for the manufacturer!

There thus appears to be a strong case for PABX suppliers to enable customers to develop their own PABX applications software. All that's now needed is for a major customer, or even ATUG, to have the guts to demand it.

When — not if — this finally occurs,we will finally have PABXs worthy of the 'fourth generation' classification. But not until then.

Stephen Coates is a Telecommunications Consultant with the NRMA Ltd. (Sydney, NSW).

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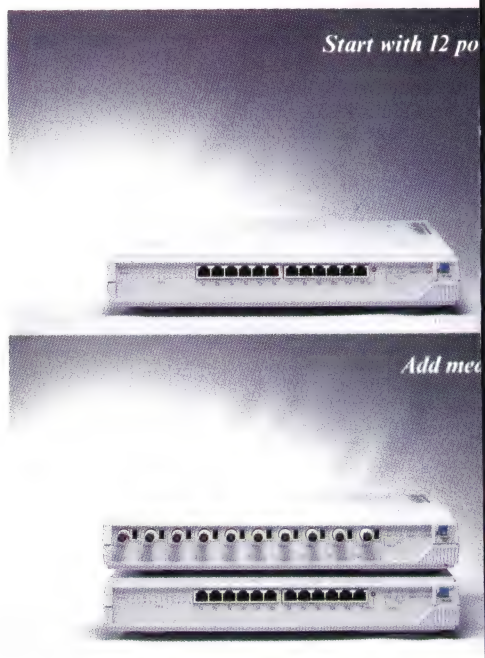


ATM from page 39

plications carried over the current 30-Mbps ATM link between its research labs in Clayton (VIC) and the Defence Science and Technology research centre in Salisbury (SA), but they need to extend this experience in commercial markets.

- To investigate CPE requirements. It is envisaged that, at the high end, ATM will be used for CAD/CAM on networked workstations, and for transferring weather information between supercomputers, and for the transfer of medical imaging. But at the low end there will also be LAN interconnect, and perhaps transportation of data between the Fastpac MAN loops.

Denis Mullane, the manager of Broadband Services, the section which runs Fastpac, says that the ATM experimental project is quite distinct from his MAN, and would only be used to link the current city-wide MANs if they "felt the need for a more flexible architecture."

However the Fastpac MAN technology won't provide the new services some CPE manufacturers are demanding. In the US, Sun Microsystems is pushing the carriers for 155Mbps data rates at the desktop for some of its new high-powered workstations, Mullane says — but he doubts that the American experience will necessarily be mirrored in Australia.

The QPSX-designed Fastpac network was supposed to be an early trial of ATM-type cell-based networks, but Australian access rates have been kept to 2Mbps and 10-Mbps (although 34Mbps and 45Mbps SMDS rates are in development in the US).

Things to Come

So what is really new and radical here? We already interconnect many of our main digital exchanges by SDH, and PDH has been around for yonks. And ATM over SDH or PDH is nothing difficult or new

Probably the real significance is that this experimental network is the harbinger of things to come. Few would now doubt that ATM-based systems (probably a cut-down version of the current B-ISDN) will be the telephone technology of the future.

And so this is the first introduction of equipment into Australia's national network which is on a direct migration path to the future. Fastpac was close, but it was more a grossly enlarged LAN than a public telephone network in design.

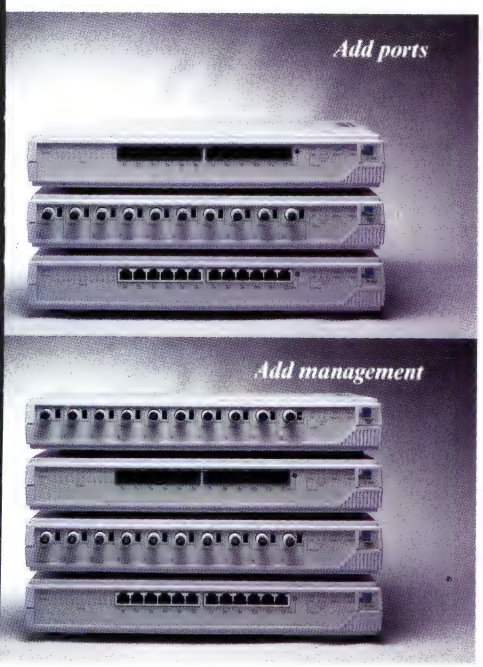
Obviously Telecom's plans even for the 1994 network are a bit vague at present. Dennis Dorman, the Manager of Network Technology Strategy, says that Telecom will buy four switches from a single vendor to be sure that they will interoperate — and the rumour is that NorTel has its foot in the door here.

Jim Parks says that we should expect ATM switches to eventually be cheaper to buy and operate than the current circuit-type switches, and so cost considerations might eventually drive ATM forward. So when the ITU-T gets its act together and puts together a suite of signalling protocols for ATM (capable of handling multipoint and multimedia connections) this ATM network will probably gradually expand, add features, and eventually become characterised as B-ISDN.

But don't expect an abrupt change in network offerings; this will be an evolutionary change with the trunk network gradually becoming more and more ATM-based, with both POTS and ISDN remaining as access technologies well into the next century. ADSL (with 1.5Mbps over copper wire) may well figure here also; it is capable of providing adequate access rates to the core ATM network for companies which have lower bandwidth requirements than those supplied by B-ISDN, but higher than POTS or ISDN. ATM over copper is just as valid as ATM over glass.

Stewart Fist

hub, a *hub*, and a **hub**.



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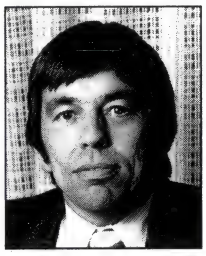


Directory Systems for the Business Enterprise

Alan Lloyd

Directory systems have been described in the previous *OSI Tutorials* (see in particular 'X.500 Electronic Directory Service' in the December/January 1992/93 edition). In these articles, directories were shown to be part of a much larger system; i.e. X.500 integrates with X.400 messaging, X.700 systems management and telephone/PABX systems.

The last few *OSI Tutorials* have looked at network design and the many operational issues associated with these new distributed technologies. Now, with the introduction of router-based networks (which are in effect a logical mesh), the approach to network design must change from that used with host-centric networks.

The additional requirements of X.400 messaging and X.500 directory systems deployed over mesh networks make the network design process even more complex.

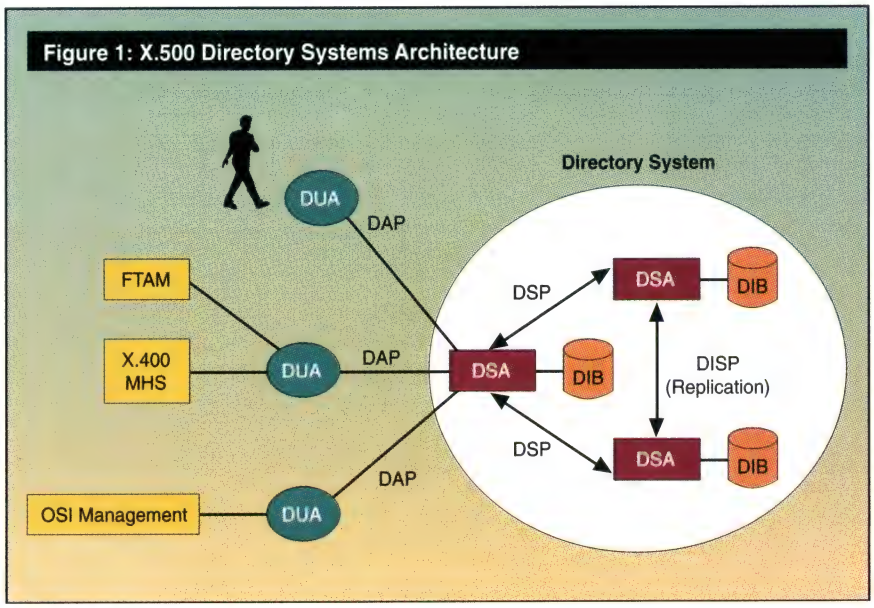
The reason is quite simple: business applications that use underlying distributed application services, such as messaging and directory systems, require network bandwidth based on:

- The application's dependency on that specific service (i.e. the application/service interaction level); and
- User service characteristics (the user's data requirements of the total distributed environment.

The first item is dependent on how users apply themselves to the business IT system (i.e. such as sending electronic mail, making specific enquiries, updating data records, etc.). Some aspects associated with distributed application design incorporating directory systems (and the naming and addressing issues) have been covered in previous *Tutorials*.

X.500 Directories

As also discussed in previous *OSI Tutorials*, there are three major components of the X.500 directory: the Directory System Agent (DSA), which is the directory engine itself that manages and stores the information; the Directory User Agent (DUA), which provides user access to the services of the Directory (the DSA); and the Directory Information Base (DIB), which is the repository for directory information within the DSAs. The term Directory Information Tree (DIT) is also used within the directory service, but this is related to the abstract structure and organisation of the DIB, which is defined as an inverted tree.



This is one of a series of open systems tutorials by Alan Lloyd, Strategic Developments Manager for Datacraft Australia. Alan represents Australia on numerous international standards bodies and is the co-author with Gary Dickson of *Open Systems Interconnection* (Prentice Hall, 1992).

The ISO/CCITT OSI systems management group (for X.700/CMIP) is working on draft papers to define the managed objects within a directory system (and the DIB) for management of the directory via X.700/CMIP.

Three protocol classes are used by the X.500 directory: the Directory Access Protocol (DAP), which provides the means for DUAs to communicate with DSAs; the Directory System Protocol (DSP), which allows DSAs to communicate with one another for distributed directory operations; and the Directory Information Systems Protocol (DISP), which is used between DSAs for the transfer of directory information during the replication process.

The significance of the Directory System Protocol is that it enables DUAs to access distributed directory information held in different DSAs via the primary Directory System Agent. Thus, directory information may be located in a number of interworking directories across different cities, states and even countries.

Users can access the directory services through DUAs. This access can be through either a user interface, for people, or an applications interface, for other programs. OSI applications use directory services because they facilitate peer connectivity and the management of distributed information, which is useful for X.400 messaging, X.700 OSI management and FTAM. The total directory system architecture is shown in Figure 1.

Directory information can be dispersed between two or more DSAs to meet the operational requirements of information distribution and replication.

A PTT, such as Telecom Australia, may own the national directory (to permit a single point for international access to the national service), but private companies

own and administer their own company-wide directories. In theory, the private directories are linked to the national directory as subordinates.

The total directory service in this configuration is known as 'distributed.' Each directory (DSA) in a system of distributed directories contains a unique part of the DIB, that is, it owns its own name space. The directory hierarchy does not prevent direct access by an authorised local user to the private directories. The same rules can also be applied to direct access from a peer directory as are applied to access from a 'superior' directory service.

By comparison, a single, isolated X.500 directory is commonly referred to as a 'centralised' directory.

Stored information (referred to as knowledge bases) is usually held at specific geographic locations. This is acceptable if the users are close to this storage facility. However, because the directory users are generally dispersed and some form of data backup or redundancy is usually required, knowledge bases need to be replicated and interlinked. The information is thus copied across two or more systems.

This configuration is referred to as 'shadowed' or 'replicated' directories. The difference between shadowed and replicated directories is that shadowed directories use a master directory and have read-only copy configuration. Replicated directories provide a copied directory service but permit DUAs to update either directory with follow-on-write through to the replicated directory using chained DSP operations.

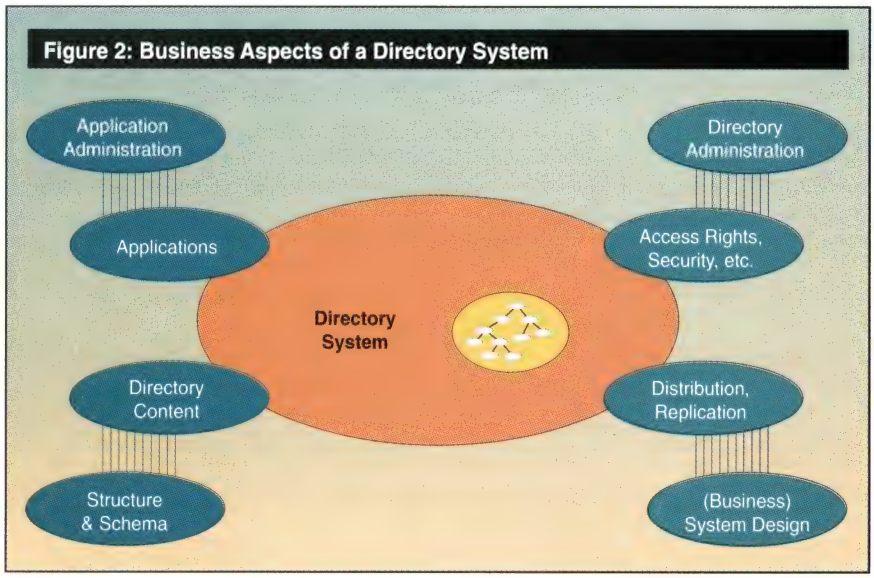
Both arrangements can reduce the cost of long distance access, minimise the access concurrency issue and meet backup and redundancy requirements. However, replicated information storage does introduce information consistency and administration issues.

Business Aspects

The major business considerations of a directory system are identified in Figure 2. As with any IT project, the first action in designing a directory system is to look at the business requirements. After all, a directory is no more than just a repository for information that serves some purpose in the business enterprise. The logical inference from this basic requirement is that the directory information must always be named, structured, administered and accessed in a consistent manner.

An application's or human's use of the directory system must be designed in conjunction with the design of the directory services. Applications must also be administered and maintained in line with the directory system.

Typically, directory supported applications must know how to access the directory information (the names of things) and what they can make use of in the way of information returned (the directory content). The applications must also be designed in a way which makes them able to handle any error condition responses that are generated (e.g. try another Directory System Agent — a referral).



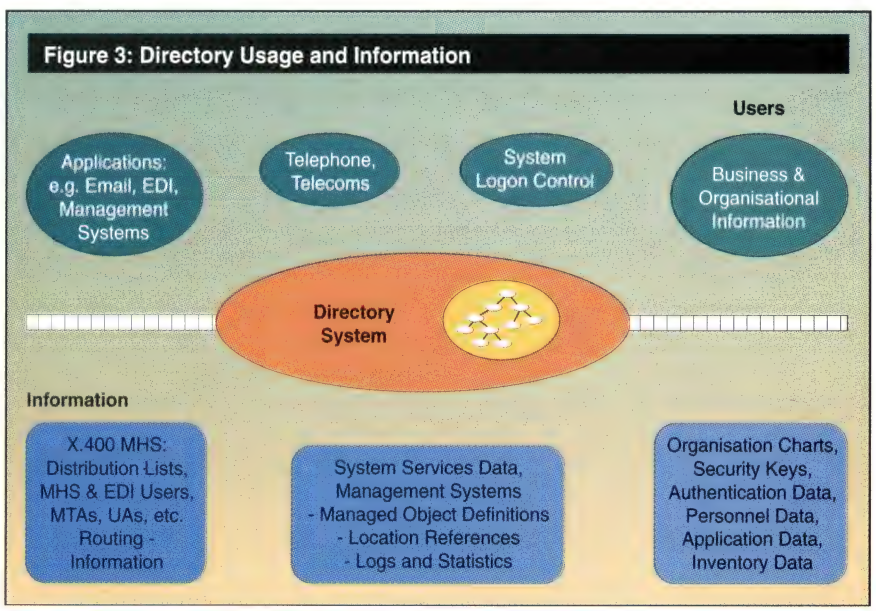
Names servers are a useful function in any distributed system, though sometimes the application design process may omit them from the base system service. This lack of integration leads to replicated information, replicated administration and possible data inconsistencies.

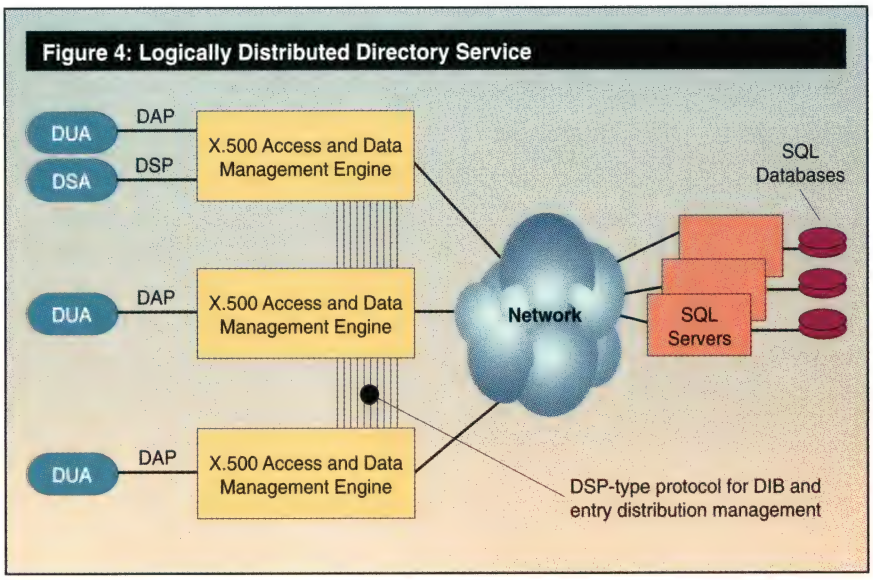
The access control and security aspects of directory system information are another business design issue, particularly if the directory information is allowed to be modified and maintained by a central source and used, with read-only access, by the total organisation. Directory systems can be a headache if they are updated frequently by many people. Information consistency becomes a particular problem if the information used by one process is updated and used by another. More importantly, if directory data is distributed and also replicated, the ability to update (or destroy) directory information from multiple sources must be controlled, If it isn't, chaos will reign.

Once the information within a directory is specified, the type of accessors and the administration of the access capability function must then be considered.

The directory content relates to what information is actually in the directory system. Content means information entries which must be referenced by name and must have a schema. For example, an entry for a country has a country name, an entry for a person has a personal name and telephone number. One cannot apply a personal telephone number to a directory entry for a country!

The fact that entries are referenced by name means that a naming scheme must be





applied throughout the directory system. And because a directory system holds information about the business enterprise, that naming scheme must reflect the business enterprise. As businesses need to be globally named and addressed (country, state, city etc.), the naming and addressing scheme must be global and internationally recognised. Only X.500 has this internationally defined and standardised naming scheme for directories.

When looking at directory system design, the content should not be seen as 'just entries' but as named items with structure rules that must be administered and protected. As stated in previous *Tutorials*, the first action of a network design is to determine the naming and addressing scheme. In directory systems (which only map names to items of information), this fundamental step is enforced.

In real life, the directory provides consistent information to as many people, organisations or applications as possible. For example, it would do nothing for the growth and productivity of the telephone service if the carrier only provided one copy of the nation's telephone directory. Distributed directories are required across an organisation if they are to be useful to the organisation's business.

Distribution, in the general sense, means copies of the same directory information are replicated across the business enterprise or hierarchically linked, distributed directory information is used. This may involve linked but independent information systems for the head office, regional offices, and branch office systems. So directory access communications requirements may affect the overall network design and the system administration requirements.

Applications and Information

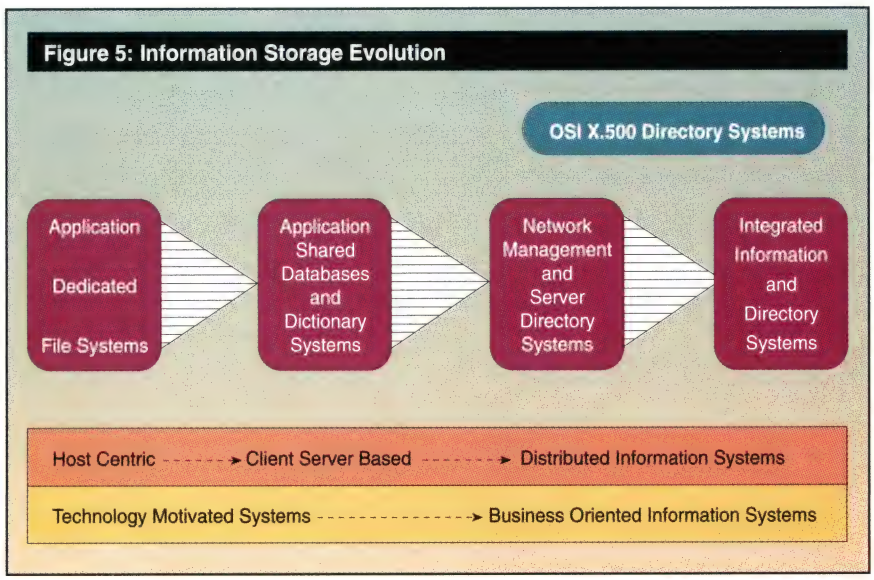
Figure 3 on page 45 identifies the typical applications of directory systems with the type of information needed to support them. Typical applications are MHS and EDI, telephone and corporate directory systems, management systems and system log on services. The lower part of Figure 3 shows the nature of the information needed for these applications.

This diagram can be used in the design of the directory system. Individual applications are listed and their information requirements are defined. The next step is to consolidate the information and define directory naming schemes.

For example, an individual within an organisation belongs to a specific department, can be contacted by the telephone system and the e-mail system, may interface to the EDI system, may look after his own security/access keys and may be able to access a range of networked services. The directory information model should reflect this access profile from both information structure, access control and named reference perspectives.

The next stage of the design process is to determine who else in the organisation wants to access such information. Consider office planners, internal and external telephone users, e-mail users, EDI trading partners and network service providers. This part of the process, particularly when applied across the total organisation, will identify the distribution and replication requirements of the directory system.

Once they are defined, these requirements are then used as input to the design of the underlying network. This information can also be used to define the directory systems management and administration requirements, the directory user's interface and the program interfaces to any integrated applications.



X.500 Implementation

There are probably two major aspects of X.500 directory implementation in a commercial environment — the implementation method of the directory information base itself and how a total directory service is designed.

X.500 systems can be designed with conventional system technologies, such as workstations, databases and GUIs.

Some X.500 products use flat file space as the storage mechanism for the directory information. This type of storage, though fast, lacks the ability to scale, lacks elegant replication mechanisms, has no transaction commitment mechanisms (for data robustness), no automatic audit and logging facilities and no optimisation tools.

Because the directory performance characteristics are business application dependent, tools are available to do performance tuning on directory operation types and directory information access.

Small scale X.500 directory systems are now being introduced with file systems as their back end storage mechanisms. These will serve the low end personal computer

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and server systems. Some directory systems with file back ends even boast replication facilities. However, these systems may not be X.500 compliant.

If a directory system is an information store for the business enterprise and that information is distributed, replicated and networked to a large scale, commercial information tools may be necessary. The directory could use a relational database back end. Commercial databases support optimisation via query optimisers, by hash, index and B-Tree referencing and by data caching. They also provide commitment services for data transaction consistency. With the introduction of networked databases and networked Structured Query Language (SQL) facilities, distribution and replication of the directory information can be achieved without major protocol or file copy mechanism developments.

With this approach, the distributed directory system designer has a choice of two different approaches for inter-DSA communication — 'Front End' communication via X.500 DSP chained operations; or 'Back End' communication via networked SQL and database facilities. The front end approach is really only necessary if DSAs are from different suppliers or across different organisations or one is hell bent on using X.500 DSP facilities.

The use of DSP is more than just protocol exchange. It also involves DSA-to-DSA knowledge management, referenced directory entries and inter-DSA information consistency.

While DSP support is provided in most Directory System Agent implementations, problems arise in consistent product management of the directory system and system robustness.

Deploying DSP may cause knowledge management problems and also operational management inconsistencies through the use of disparate tools and the solution may lack robustness because of the immaturity of DSP systems. The use of DSP between Directory System Agents will occur, but product stability in this area (as required for commercial use) is still a few years off.

Using the back end approach simplifies these issues considerably. The back end choice is especially useful if consistent administration, tuning and access optimisation is needed across a range of DSAs which form a corporate directory service. The distributed SQL version also permits the use of consistent, commercially available system administration utilities, such as report generators and configuration tools.

System Design

As with X.400 messaging, the directory in its complete and true distributed form will take time to be fully deployed as a real global directory service. X.400 MHS has now started to define its higher layer management in line with Telecommunications Management Network (TMN) CCITT M series standards. The X.500 directory is likely to be the next candidate for the TMN process.

The distinction between the standard and the way technology serves the implementation will also need consideration. For example, a DSA can be implemented as an X.500 server with a number of back end SQL servers as the storage system.

Alternatively, a distributed DSA system can consist of a number of networked SQL servers with a number of communicating front end X.500 processors/servers which interconnect to control the replication and distribution aspects of X.500 and its DIB. This configuration is shown in Figure 4 on page 46.

Bearing in mind that the directory system is shared by X.400 messaging, which usually runs on the servers, is accessed by DUAs and X.400 user agents, which usually run on the PCs attached to the servers, and that these PCs also access the services of remote applications, the network design issues do become quite complex. It might be possible for the broadcasting or publishing of directory information content to be interlinked to the distribution capabilities of X.400 messaging systems.

If directory systems seem a complex way of dealing with information, remember that many organisations are dealing with replicated, unconnected data and are paying hundreds of thousands of dollars to maintain a normal, printed telephone directory. Many are attempting to deal with this repeated cost with, believe it or not, computers and networks!

Over the years, information storage has evolved from the dedicated application/file space to relational databases and is moving towards distributed directory systems, as show in Figure 5 on page 46. The diagram also shows the shift from technology-led to business-led systems.

Given that the cost of technology is falling and the cost of information and system administration is rising, consolidating the information into a system that serves the business is an optimisation process, not an additional cost. My suggestion is to set up a small research project on directory system usage and the costs of using common information sources. You may get some pleasant surprises. You can implement the technology and save money.

However, it is worth noting that to build a distributed system infrastructure for a business enterprise does require a different skill base to that of 'plugging up products.' In the longer term, building a network that can be understood by the business managers, managed by the IT department and give consistent services to its users must be the better approach.

Alan Lloyd

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INS Product Leaders

TEST INSTRUMENTATION • NETWORK MANAGEMENT SYSTEMS

LAN/WAN ANALYSER

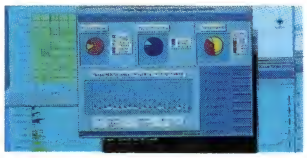
LAN: Token Ring
ETHERNET

WAN: ISDN
FASTPAC
AUSTPAC
TRANSEND
DDN
SNA

PROTOCOLS:

X.25, SNA, HDLC, SDLC, SS7, Q921/Q931, XNS, TCP/IP, NETBIOS, NETBUI, ISO, APPLETALK, MBI, DECNET, SUNNFS, X-WINDOWS, SNMP.

CENTRALISED LAN MANAGEMENT-RMON



- Full RMON MIB.
- Graphical Interface.
- Total Network Management across entire network.
- Seven - Layer decodes for all major protocols.

PC-BASED BERT

- Turn your PC into high speed BERT.
- Support RS232, V.35, X21, G703, G704.
- G821 analysis with histogram and capture to disk.
- G704 monitor tool.

NOTEBOOK BASED WAN ANALYSER

- Full Duplex to 2MBPS.
- E1 and Fractional E1.
- SNA, X.25, ISDN.
- Frame Relay, SMDS.
- Dual Channel.
- Graphical Interface.

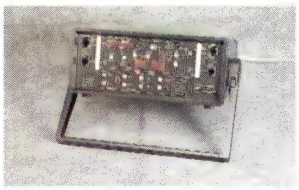
NETWORK PROBE

- Multi-function analyser.
- Built-in interfaces for RS232, X.21, V.35, ISDN.
- Multiple protocols support.
- Light weight/low cost.
- AC/DC operated.

TDR/LAN SCANNER

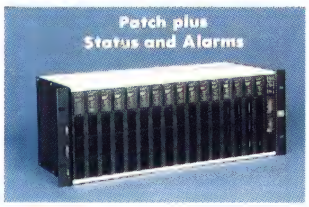
- TDR and cable scanning for UTP, STP, Coax, IBM cabling, up to 100MBPS.
- Measures NEXT, length, ATTENUATION, Resistance, continuity, LAN monitor.
- Optional cable management and cable grading software.

SIMULATORS



- Most major Telephone network types.
- DDS, ISDN links.
- DDS, ISDN cables.
- Multiple cable gauges, length and speed up to 34.8MBPS.

DATA PATCH/ SWITCH SYSTEMS



- Circuit switching and PATCHING.
- RS232, V.35, X.21, G703 etc.
- Transparent to protocol.
- Full remote or local control.

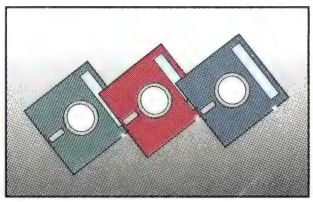
PC-BASED PROTOCOL ANALYSER

- Turn PC into full function protocol analyser.
- Half size card supporting major protocols, interfaces.
- Speed up to 2MBPS.

LIGHT SOURCE/OTDR/ POWER METER

- Fiberoptic test equipment for LAN, WAN, FDDI.
- PC-based and hand-held.
- Power attenuation, dual wave length test systems, LED or Laser sources, Talk sets.

SOFTWARE



- LAN management software for Ethernet, Token Ring, ARCNET and Appletalk.
- Comprehensive statistics and protocol decodes.
- Low, low, cost!

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- ☐ NETWORK PROBE
- ☐ FIBEROPTIC TEST EQUIPMENT
- ☐ LAN MANAGEMENT - RMON
- ☐ LAN/WAN ANALYSER
- ☐ PC-BASED BERT
- ☐ SIMULATOR
- ☐ SOFTWARE
- ☐ WAN ANALYSER
- ☐ DATA PATCH/SWITCH SYSTEM
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Fast, Flexible Ethernet Brouter

Chipcom's new ONline Ethernet Interconnect Module combines error checking with fast packet switching.

This year US-based Chipcom celebrates its 10th birthday. Over that period, Chipcom has grown steadily and consistently, and this growth has been based on the delivery of several cost effective product lines, the latest of which is the ONline family of switching hubs.

All of Chipcom's products are intended to provide dependable, scalable and technically clean standards-based solutions. Chipcom's ONline family is composed of several interchangeable modules, which can be mounted in either a six- or 17-slot, triple backplane chassis — referred to as ONline System Concentrators.

Chipcom believes that its triple backplane architecture, which it refers to as TriChannel architecture, is the most cost effective solution for the bulk of the market's needs. Each backplane may be configured as a separate Ethernet, Token Ring or FDDI, the idea being that, for example, one backplane can be used for strictly LAN traffic, while a second could be reserved for a campus backbone, and the third for a WAN backbone.

The advantage of this arrangement is that through traffic on either backbone has no impact on LAN operations, and that LAN operations most likely to be heavily reliant on broadcast traffic will be confined to the local network. Chipcom's ONline family contains a variety of bridge and/or router modules which allow access between backplanes and assorted WAN interfaces.

Other modules provide various types of Ethernet (from UTP to Fibre), Token Ring and FDDI ports, a terminal server (LAT and TCP/IP are supported, as is BOOTP, TFTP, MOP and DEC's TSM management tools) and both Ethernet and Token Ring management modules (supporting Local Console, Telnet, SNMP, DECmcc and SunNet Manager access).

Chipcom's newest module is the ONline Ethernet Interconnect Module (OEIM). Unfortunately, as its name fails to imply the OEIM is a local Ethernet bridge/router with switching capability (why couldn't they just call it a Switching Brouter?). The unit occupies two slots in either ONline chassis and has eight ports, six of which may be activated at any one time. The unit has one port per backplane, three 10Base-T ports and two AUI ports, and also has a serial port for management via a terminal or a modem. The 10Base-T and AUI ports are located on the front panel.

Configuration of active ports and all switching, bridging and routing functions are software controlled. The unit stores configurations in Flash memory, which permits software downloads from remote sources. Any of the unit's parameters can be reconfigured 'on-the-fly' from any supported management interfaces. The unit's six active ports provide up to three parallel full bandwidth Ethernet channels.

Where Chipcom's unit differs from the Kalpana Etherswitch is in the method by which switching is achieved. The OEIM switches a packet after basic error checking. As a result, the unit cannot be overloaded by, for instance, a workstation or server broadcasting a large number of packets with bad CRCs.

This incurs a speed penalty, but since the OEIM uses an i960 RISC processor it can still function at 'wire speed.' The unit is rated at an effective filtering rate of 90,000pps and a forwarding rate of over 42,000pps.

The OEIM's switching mode is its basic mode of operation. With a software upgrade the unit can operate as either a bridge or a router. As a bridge, the unit provides all the usual options such as support for the spanning tree algorithm and a very flexible set of filtering options. As router the unit supports IP (OSPF or RIP), IPX/SPX and DECnet Phase IV Release 2.0, and Chipcom has plans to support OSI, AppleTalk and Banyan's Vines in the future.

Traffic Control

By combining the OEIM with other modules in the ONline family it is possible to construct a very flexible transmission system which is capable of automatically reconfiguring itself in response to system traffic loads following several different topographical models.

By using Chipcom's TriChannel architecture and a combination of switching, bridging and routing, customers can isolate sections of their network system for security reasons, to reserve bandwidth or provide a channel for 'through traffic' arising from a given site's participation in an enterprise WAN. This latter function is important in WAN designs which feature the use of routers or bridges which employ dynamic traffic control algorithms in conjunction with redundant WAN paths.

For example, consider a network comprising sites in Sydney, Brisbane and Perth, all of which are directly linked. If the direct link between Sydney and Brisbane goes down, the WAN's routers might divert traffic via Perth. If the Perth office has two separate routers which are on the same backbone as the servers and workstations in that office, then users in Perth will suffer an increase in response time. By placing routers on a separate backplane within a Chipcom concentrator, the Perth office LAN is unaffected. In such a situation the WAN is likely to be limited by the bandwidth of telecommunications links between cities rather than the Chipcom unit's latency.

In summary, good throughput, cost efficiency and powerful configuration options makes the OEIM, and indeed the entire ONline family, worth a close look if you're trying to build a reliable, flexible, scalable — and not to mention upgradable — network transmission system. If only they'd chosen a more sensible name . . .

Graeme Le Roux

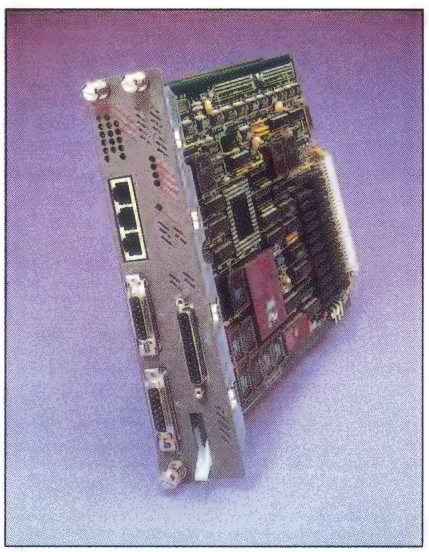
PRODUCT SUMMARY

Name: ONline Ethernet Interconnect Module

Description: ONline hub module which can be configured as an Ethernet switch, bridge, or multiprotocol bridge/router

Price: $15,000 to $85,00, depending on configuration. All prices are RRP ex tax

Vendor: Chipcom International, Suite 18, 12 Tryon Rd, Lindfield NSW 2070 Tel: (02) 416 0653



Broadening Analyser Horizons

Tekelec's Chameleon Open combines capability and capacity in an easy-to-use LAN/WAN analyser.

When it comes to protocol analysers, net managers are still searching for an elusive combination: comprehensive and comprehensible. High-end gear, which decodes most layers of the stack, is tough to work with. Low-end offerings are easy to use but offer a limited look at network activity.

Tekelec aims to fill the bill with Chameleon Open, a user- friendly portable LAN/WAN analyser that decodes all layers of most LAN and WAN protocols found on today's internetworks — including all the LAN protocols encapsulated in frame relay or US SMDS packets.

Chameleon Open handles up to seven LAN or three WAN connections simultaneously; its chief competitor, the DA-30 from Wandel & Goltermann, can handle only two networks at a time.

Despite its sophisticated abilities, Chameleon Open has a colourful, icon-driven X-Windows interface that's intelligible to users. This interface initially was offered by Tekelec in two earlier products, the Chameleon 100 and the Chameleon 1800. Users simply open windows to add connections to the current session. The product's reliance on X-Windows also makes it easy to control remotely, and Tekelec offers optional Ethernet-based software for that purpose.

Chameleon Open can filter traffic by protocol or by packet part, such as header, giving users a wide choice of ways to monitor data traffic. Users select these options from the main menu bar.

The analyser also decodes TCP/IP and Network file system (NFS) packets encapsulated within frame relay running at T1 (1.5Mbps) or E1 (2.048Mbps) or in SMDS frames running at US T3 (45Mbps) speeds. Net managers can buy LAN Protocol Decode software to test AppleTalk, Banyan Vines, DECnet, NetWare, OSI, XNS, and XTP protocols encapsulated within these WAN formats as well as on LANs. For US users, Chameleon Open also performs T3 (45Mbps) decoding of the subscriber Network Interface (SNI) on SMDS (Switched Multimegabit Data Service) links, which specifies how bridges, routers, and other CPE connects with public SMDS offerings.

Even with all its strengths, the Tekelec box suffers from some of the same disadvantages that plague other analysers. Like other products which rely on packet addressing schemes to decode encapsulated protocols, Chameleon Open is not able to decode protocols encapsulated inside ISDN primary-rate interface and X.25 frames. Instead, the analyser decodes the first three layers of these protocols and displays the upper-layer protocol information as raw ASCII or hexadecimal data.

With the exception of frame relay, the unit simulates all protocols it decodes, so managers can see what happens when various types of traffic are added to the mix. The vendor's optional Frame Relay Load Generator package gives only rough simulation of the protocol. At present the analyser can only simulate encapsulated LAN/WAN protocols on LAN connections.

A Seven-Slot Machine

True to its name, the Chameleon Open changes its character as application modules are added to the unit's seven-slot chassis, which is equipped with a 33MHz Intel 486 processor running Unix, 16MB of memory, and a 240MB hard drive. Tekelec offers six application modules (each WAN module occupies two slots): a two-card SMDS SNI set that runs at T1 or T3; a two-card set with T1, V.35, EIA-232, and EIA-449 interfaces that runs at E1; a two-card set with the same interfaces that handles T1 speeds; a two-card combination set with these interfaces capable of both T1 and E1 rates; and single-card Ethernet and Token Ring modules. Tekelec says it plans to release both ATM and FDDI add-in modules for the analyser.

PRODUCT SUMMARY

Name: Chameleon Open

Description: A seven-slot portable LAN/WAN protocol analyser that can concurrently decode multiple protocols, including frame relay, ISDN primary-rate interface (PRI), X.25, and LAN, on E1, Ethernet, and Token Ring networks. Also simulates protocols, with varying degrees of granularity

Price: Chameleon Open base system — $39,750; grey-scale version — P.O.A.; slot-in application modules cost from $10,500 to $15,700; Frame Relay Load Generator software — $2,600; LAN Protocol Decode software $6,050. All prices include tax

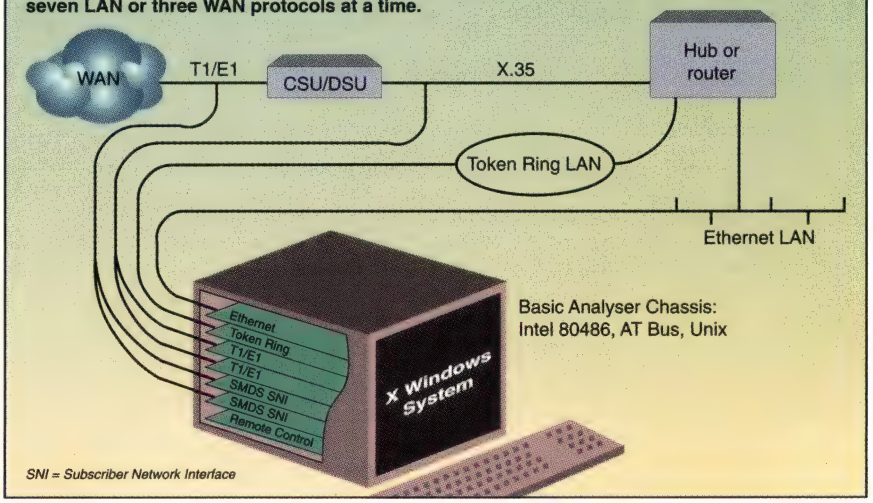
Vendor: Tekelec Australia, Unit 14/41 Rickard Road, Bankstown NSW 2200. Tel: (02) 790 2200

Each application module has an integral processor and memory tailored to the protocol it handles. For example, the SMDS module has two RISC processors and 4MB of RAM, while the T1 and LAN modules contain Motorola 68020 or 68030 chips and 4 or 8MB of RAM. By dedicating processing power to individual network connections, the vendor says data can be captured at full line speed and performance won't diminish when multiple connections are active.

Mary Jander

Add Modules to a Mutable Analyser

The Chameleon Open from Tekelec changes its nature as application modules for different protocols are slotted in. The analyser decodes all layers of the stack and can handle up to seven LAN or three WAN protocols at a time.



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AC 10

Videoconferencing to the Desktop

The Picturetel PCS 100 PC videoconferencing system is as easy to use as a telephone.

There's good news for network managers who've longed for an easy-to-use desktop alternative to rollabout videoconferencing systems. The Picturetel Live PCS 100 Personal Visual Communications System for PCs from Picturetel Corp. is the lowest-cost PC videoconferencing system from a major vendor. PCS 100, comprising a speakerphone and video camera, two PC boards, and Windows interface software, is as easy to use as a regular telephone. And while it is not compatible with LAN network operating systems, it has several features that let users share information, such as screens for viewing and annotating documents during a videoconference.

The PCS 100 complies with the H.320 videoconferencing specification of the CCITT, so it will work with any other system that conforms to spec. H.320 is an umbrella standard that incorporates several other specs that define coding and transmission of video signals, including H.261, H.221, H.230 and H.242. Additionally, the PCS 100 implements a series of proprietary algorithms that significantly improve the quality of videoconferencing sessions, the vendor says. These include voice and video data compression schemes that leave more bandwidth free for video, and techniques that improve audio quality. These algorithms don't interfere with the PCS 100's standards compliance.

In addition to working with standard third-party desktop and group conferencing systems and MCUs (multipoint control units), the PCS 100 also is compatible with Picturetel's System 4000 and System 100 rollabout videoconferencing systems.

Ironically, though the PCS 100 is standards-compliant, the lack of international standards for some of its key features limits the unit's capabilities. Specifically, while it works with any standard MCU, a PC screen can display just one incoming video window at a time. Also, only two simultaneous users can take advantage of the PCS 100's information-sharing features. The H.320 specs don't currently cover data sharing among multiple users or multiple video windows on a desktop system. Picturetel expects that standards for these features will be in place by early next year; at that time the vendor will upgrade the PCS 100 to support them.

Click-on Capabilities

Designed for ISA-bus, Intel-based PCs running Microsoft Windows 3.1, the PCS 100 is driven by a Windows application available in English, French, Spanish, German and Japanese. Users click on icons to select options that include a phone book and on-screen dial pad; volume control; a call log; and a snapshot capability that lets users capture images from video windows and paste them into documents or save the images as PC files.

Information-sharing features include the ability to simultaneously run a video-conference and an application on a PC screen. At present users can't change applications in the midst of a videoconference, but Picturetel says that capability will be available early in 1994. Videoconference participants also can use an on-screen 'whiteboard' to take notes during a conference. And users can use a portion of videoconferencing bandwidth to transfer files between the PCS 100 and other systems during a call.

Picturetel also has extended the Windows Clipboard function to include remote capability, so that conference participants can clip and save items to their Windows Clipboards and remote users can paste those items into their applications.

Take Better Pictures

The PCS has two ISA boards, one containing video circuitry, and one with audio components and an ISDN basic-rate adaptor. The first release of PCS 100 works only over 128Kbps ISDN lines. Picturetel plans to release cards for other switched services, including V.35, RS-449 and switched 56Kbps connections shortly. The additional adaptor cards occupy a third slot in the PC.

PRODUCT SUMMARY

Name: Picturetel Live PCS 100 Personal Visual Communications System

Description: A Windows-based desktop PC videoconferencing system that operates over ISDN basic-rate lines, features full-colour, full-motion video, and complies with international standards.

Price: Around $12,000

Vendor: Picturetel Corporation

Distributor: AAP Communications Services, 30 Ross St, Glebe NSW 2037. Tel: (02) 692 1000

On the computer screen, the image is shown in standard Super VGA graphics format, and resolution can either be 288 by 352 pixels, or 144 by 176 pixels. The non-video portion also is standard Super VGA — 1,024 by 768 pixels with 256 colours.

The PCS 100's audio boards use proprietary algorithms that the vendor says will improve video sessions over and above what the standard defines. Among the algorithms is the PT724 audio algorithm, which compresses 7KHz audio so it can be sent at 24Kbps instead of the usual 48Kbps or 56Kbps. so the remaining bandwidth can be devoted to video, which improves the on-screen image. Picturetel says it will try to standardise PT724.

The audio boards deploy IDEC II, an enhanced version of the vendor's Integrated Dynamic Echo Cancellation (IDEC) algorithm that automatically elevates speakers' voices as they move around a room, and eliminates white noise from the audio transmission. IDEC II could play a key role in conducting video conferences on noisy trading floors or in factories.

The PCS 100 package comes complete with a camera, handset and cabling. The full-motion, full-colour Flipcam video camera has a stand that can be flipped to focus the camera up on people in the room or down on a document that users want to broadcast. Adjustments for lighting, zoom and focus are all manual, and located on the camera. A second window on the computer screen helps users adjust outgoing images. The PCS 100's video and audio boards are connected by ribbon cable. The boards process information locally without taxing the PC's bus.

Mary Jander

Here's How Our Token Ring Products Stack Up To The Competition's.

Stack us up to any other major hub vendor, and see for yourself. Cabletron offers more Token Ring modules for the intelligent hub than the competition. Period.

But that's only the beginning.

Our Token Ring products are driven by Intel's high-performance i960 32-bit RISC processor. The competition's? 16 bits. Our active Token Ring modules provide up to 24 ports. The other guy's? Half that. And we have an integrated solution for bridging Ethernet, Token Ring and Wide Area Networks with a single module. Their solution? A stand-alone box.

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With 19 modules for our MMAC hub, Cabletron's Token Ring solution is "the complete solution." Theirs? Well, they simply don't stack up.

For more information on Cabletron's Complete Token Ring Solution, give us a call at **(02) 878 5777.** And ask for your free copy of Cabletron's *SNA and Token Ring Integration Strategy,* the white paper that maps out a smooth migration to the "new" SNA and integrated SNA/Token Ring environments.

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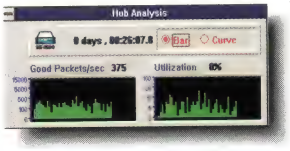
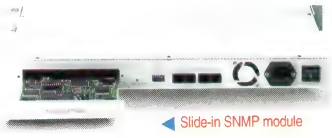


▲D-View SNMP network management program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Copyright or Copywrong: Software Law Reform

Significant changes seem likely to Australia's copyright laws relating to computer software. Peter Waters discusses the CLRC's draft report and the potential implications for the IT industry.

After a long-running inquiry, the Copyright Law Review Committee recently has released a draft report on the adequacy of Australia's laws protecting intellectual property rights in computer software. The CLRC's inquiry is the latest in a series of similar reviews internationally, including in the US and the European Community. Australia is the newest 'theatre of war' in the ongoing worldwide battle between the large software houses and proprietary systems supporters, and the supporters of open systems. The CLRC's draft report amounts to a cautious, but limited, endorsement of open systems.

Most countries have opted for the 'quick fix' of deeming software to be a literary work, like a novel, for copyright purposes. The CLRC thought that a new copyright category for software would have been better but that the current approach now was too embedded. The CLRC's job then was to make the current law better fit the technical realities of software.

Protectable Elements

Copyright does not protect 'ideas,' but only the 'expression' of those ideas. It is no easy task deciding on which side of the ideas/expression line the different elements of a computer program fall. There is not much assistance to be found in the definition of computer program in the *Copyright Act*: 'computer program means an expression, in any language code or notation of a set of instructions (whether with or without related information) intended . . . to cause a device having digital information processing capabilities to perform a particular function.' The CLRC recommended that the Australian definition be scrapped and replaced with the US definition: 'a computer program is a set of statements or instructions to be used directly or indirectly in a computer to bring about a certain result.' A US-style definition would put beyond doubt that programs written in source code, object code and microcode are all protected, and the word 'statements' would make it clear that protection is also extended to computer programs written in the newer declarative programming languages (4GL).

However, the CLRC refused to follow the US — and, more recently, the Japanese and EC — approaches of also specifying which elements of a computer program are not protectable: in these countries, copyright protection expressly does not cover the underlying procedures, processes, methods of operation, algorithms, programming languages, and elements underlying interfaces.

The CLRC thought that the Explanatory Memorandum accompanying the computer-related amendments to our *Copyright Act* and a series of court decisions already clarified that many of these elements were not protectable in Australia.

However, recent experience suggests that the CLRC's faith is misplaced. After five attempts (including two by the High Court), the courts finally 'got it right' in Autodesk, but lawyers still cannot agree on exactly what the case means. Continuing uncertainty regarding what elements of a computer program are or are not protectable is not in the interests of any industry player, and the uncertainty itself can have a 'chilling effect' on innovation. As computer software is an internationally traded commodity, it is also important that foreign developers be able to determine the level of protection available in Australia compared to other countries in which their software is distributed. Codification of both the protectable and unprotectable elements of software would achieve these objectives.

Look and Feel

It has been argued strongly, and accepted by some US courts, that copyright protection needs to reach beyond merely protecting the internal source or object code against copying. It is possible to avoid copying a substantial proportion of a program's code, and yet produce another program which has a substantially similar user interface or substantially similar structure, sequence and organisation: that is, the later-developed program has such an uncannily similar 'look and feel' as the earlier program that it has to be regarded as a copy.

Proponents of 'look and feel' copyright argue that often the most clever and original parts of a program are its so-called non-literal elements and, as IBM puts it, 'the final step in the process — and the one that software developers routinely entrust to junior programmers — is the coding step . . . the coding is a form of authorship least difficult to master.' IBM submitted to the CLRC that the *Copyright Act* should explicitly protect the structure , sequence and organisation of a program.

On the other side of the fence, opponents of 'look and feel' argue that the structure, sequence and organisation of a program are unprotectable ideas and, as Fujitsu said, 'users expect and demand basic similarities in the sequence of displays and in the syntax and meaning of commands eg. scroll bars or close-icons when invoking similar functions.'

Firmly rejecting 'look and feel' copyright, the CLRC said: 'it seems to the Committee that the true goal of those seeking to protect the 'non-code' behavioural aspects of computer programs is to prevent the development of competitive functional equivalents . . . the author of a computer program should [not] be able to prevent the development of functional equivalents which are independently created in circumstances where neither the source or object code has been coded. The protection of function is not and should not be an object of copyright protection.'

However, the CLRC thought that more than just the literal coding should be protected. The CLRC drew a distinction between the 'textual elements' (i.e. the code) and the 'behavioural elements' of a program, each of which had its own separate structure, sequence and organisation.

The CLRC gave the example of 'delete word' and 'delete paragraph' functions in a word processing program. In the sequence of the coding, delete word may appear before delete paragraph. However, the order of these functions could be changed around without affecting the program's behaviour. Accordingly, a user of the two programs would be unable to tell which program he or she was using because, although the structure, sequence and organisation of the text differs, the structure, sequence and organisation of the behaviour remains the same.

The CLRC concluded that the structure, sequence and organisation aspects of the behaviours of a computer program, and in particular, user interfaces, should not be protected. The CLRC noted 'the danger to the industry as a whole in encouraging diversity for diversity's sake, where the resulting variations do not result in the most efficient and acceptable user interfaces being used or developed simply because the most efficient and user-friendly features have copyright protection.'

On the other hand, the CLRC thought that the structure, sequence and organisation of the text or coding should be protected. The CLRC noted that creating the structure, interaction of the modules, and organisation of the program forms are of the most time-consuming and expensive components of programming. If the CLRC's recommendations are adopted, Australia will avoid the worst excesses of the US 'look and feel' doctrine, while providing a reasonable level of protection to the non-literal 'cleverness' of a particular program.

However, the CLRC should have gone further to recommend that the *Copyright Act* expressly provide that interface specifications do not form part of the literal elements of a program. The right to replicate these protocols is essential in achieving interoperability of different programs in an open environment, as recognised in the US *Copyright Act* and the EC Software Directive.

Reverse Engineering

Unlike a book, it is not usually possible to discern the unprotected ideas underlying the protected expression by merely observing a computer program running. Because computer programs are typically distributed in a form not perceptible to the human eye, the program has to be decompiled and analysed to discover the ideas. The 'technological quirks' of the medium in which computer programs are expressed should not give the copyright owner a higher level of protection than authors of more traditional works have.

As the CLRC noted, the large number of ways and the number of steps that can be involved in the compilation of source code to object code mean that it is highly unlikely decompilation will lead back to a complete copy of the original source code.

However, rather than recommending a general statutory right to decompile, the CLRC opted for limited decompilation in closely defined circumstances. Decompilation should be allowed to achieve the interoperability of programs provided:

- Decompilation is performed by the owner or user of a lawfully acquired program;
- Information to achieve interoperability has not previously been published;
- The acts are confined to the parts of the program necessary to achieve interoperability; and
- the information discovered should only be given to others when necessary to achieve interoperability.

While the CLRC focused on software/software interoperability, similar problems can also arise with software/hardware interoperability. There are occasions where the developer of new hardware, particularly a CPU, may be required to decompile another company's computer program, usually an operating system program, to ensure that the new hardware will interoperate successfully with the computer program. This problem could also be avoided if the CLRC extended the interoperability decompilation right to achieving 'interoperability of an independently created program or hardware device with other programs or hardware devices.'

The CLRC's definition of 'interoperability' may be too narrow, and hence the decompilation right may be too constrained. The CLRC defines interoperability as 'the ability of computer systems to communicate with other hardware systems' computer programs in order that they work together on some task.'

Interoperability amounts to more than interaction with 'hardware systems' computer programs' but includes a much broader range of interaction involving other programs, hardware or users. For example, an IBM-compatible PC-BIOS — the most widespread compatible program in the world today — is interoperable not only with 'other hardware systems' computer programs,' but also with application programs running on the PC such as Lotus 1-2-3 and WordPerfect, with operating system software (such as MS-DOS), with the PC hardware itself, and with peripheral hardware devices such as printers and modems.

There was a great debate in the European Community over whether the similar interoperability decompilation right could be used for the development of 'competing' products. In the end, this debate was resolved in favour of permitting decompilation for the purposes of creating competing products, as long as the decompilation was necessary to achieve interoperability with some other program(s) — not necessarily with the decompiled program. For example, decompilation of the IBM BIOS to develop a non-infringing compatible — and competing — BIOS on which could be run any programs which can be run on the IBM BIOS.

The second situation in which the CLRC said decompilation should be permitted is error correction or debugging, subject to the limitation that debugged version will not be available from the copyright holder within a reasonable time and at a normal commercial price. The CLRC noted that the manufacturer of the program is not always better placed than the user to identify and fix bugs. The difficulties may not arise from the program alone, but when it is run on a complex multi-user system interacting with other programs. Correction may involve any combination of modification of the source code, or of the object code, or the creation of additional programs or patches. In these situations, the user will have more relevant knowledge and expertise than any one manufacturer of any potentially troublesome programs running on the system.

Debate over the issues considered by the CLRC has been hard fought and at times vitriolic. However, the CLRC has managed to come up with a set of recommendations which seem a balanced, workable compromise between the interests of copyright holders of software and the public interest in encouraging continued innovation and development in the industry.

Peter Waters is a partner of Gilbert & Tobin, and specialises in information technology and telecommunications. *The input of Rob Townsend of Morrison and Foerster, Japan, is acknowledged.*

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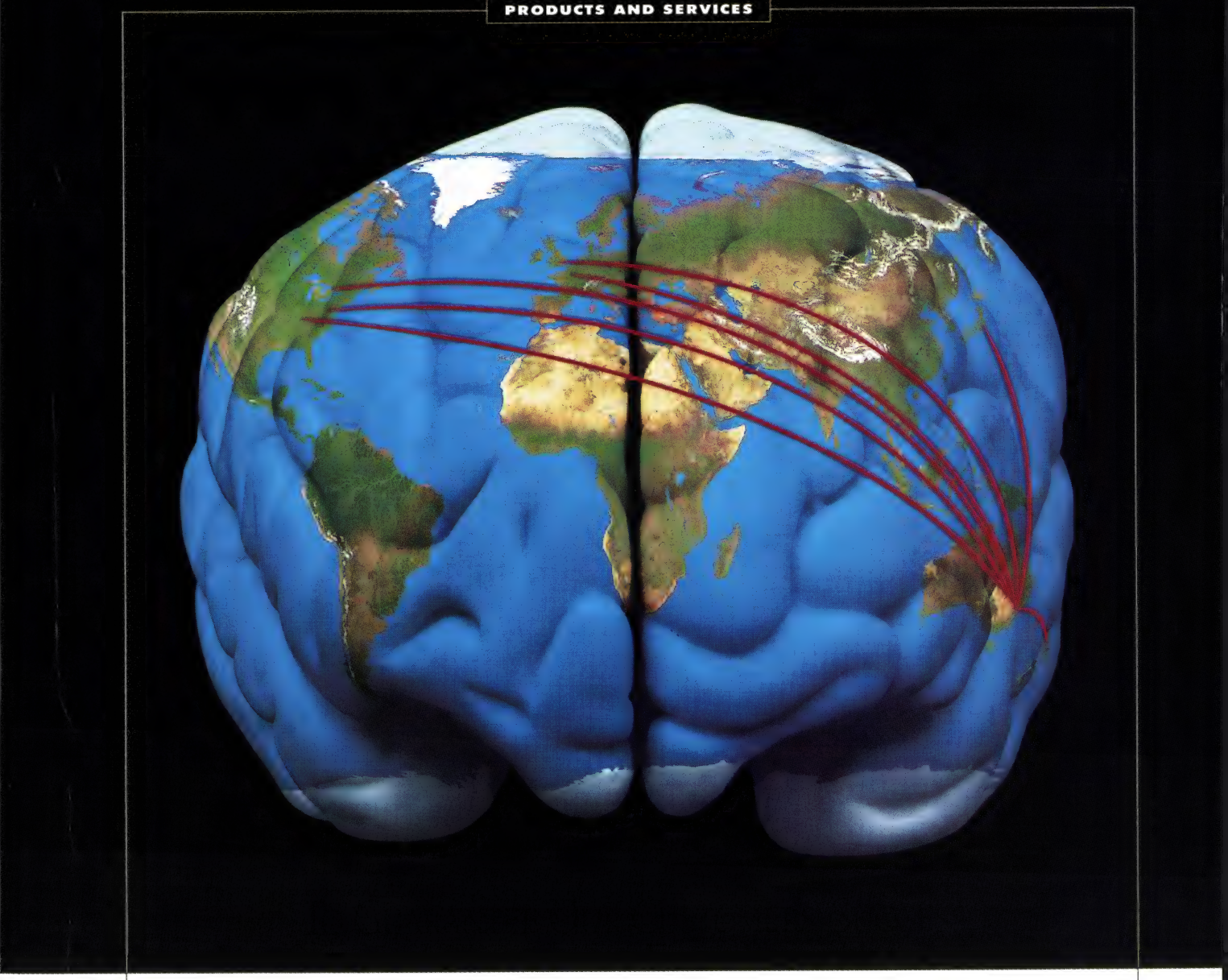

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Steering the Communications Export Drive

Roger Knight

National Manager, Communications and Technology, Australian Trade Commission

Roger Knight was appointed last year as National Manager of the Communications and Technology Business Development Unit at the Australian Trade Commission (Austrade). Prior to this, he was International Marketing Manager for Chemtronics Ltd, where he spent much of his time overseas, particularly in Asia. He has also worked as a Business Development Manager with ICI Instruments Australia. Knight has a doctorate in Electroanalytical Methodologies from Deakin University and has completed a graduate management qualification from the Australian Graduate School of Management. Last month at Austrade's Sydney office he spoke with Liz Fell.

Where does the Australian telecoms industry have a relative advantage in exporting to the Asian market?

Knight: We have tremendous equipment suppliers and service providers who underpin the whole Australian infrastructure, because we've gone right through the business chain in so many different areas and developed such a leading edge network. Just statistically, Australia and Japan are by far the leading countries in this region. In the short term, we must take advantage of this and position ourselves as a leading edge innovation country because as other nations develop their infrastructures, our size is going to limit us in terms of attracting investment and so on.

So we must continue to re-offer products and services of innovation which these countries will happily take on.

AC: *In a table you presented to the recent IIR industry conference, Australia looked well-positioned in Asia in terms of major equipment manufacturers.*

Knight: That table highlighted the fact that we've had a lot of investment here by transnational companies, which reflects the expenditure on our network. But if you were sitting in a transnational wondering where to put your next investment dollar, would you look at Australia, given its smaller growth rates and size relative to some large underdeveloped nations such as China, India or Indonesia? It's a pretty obvious question. Without a strategy that takes advantage of where Australia is now and positions us for the longer term, we're likely to become a very small player.

AC: *What does that strategy involve?*

Knight: We've got to focus on those areas where we add value in the business chain. An example is the NorTel-Exicom arrangement where they're looking at R&D, product development and manufacturing of the latest telephone sets that can be taken back to the US through NorTel's distribution network. That is, for want of a better word, a 'niche' area of manufacturing that we can capitalise on and stay ahead of the pack. There are other areas where we could prosper, such as the smart card technology underpinning GSM. If we can get into those 'niche' areas, the manufacturing side has a very healthy outlook.

AC: *How can you compare Australia with Japan in terms of a leading role?*

Knight: We're comparable to Japan in many ways. In fact, we probably have a more multi-dimensional industry because of our additional requirements for solving problems associated with rural communications, given our vast distances and extreme climate. Accordingly, we have a lot of innovative technology which adds an extra dimension to what we can actually offer.

AC: *What are the implications of Telstra reducing the number of switching and transmission suppliers?*

Knight: I don't know that anyone has done any calculations profiling the different scenarios of how domestic supply capacity will ultimately impact on our export ability in those manufacturing areas.

AC: *In your IIR conference paper, you call for a re-examination of the notion of exports. What would that involve?*

Knight: If you actually look back at the origins of the word 'export' and some of the definitions, they are fairly dated. They don't take into account our move towards provision of services, for instance, or the global way we operate. In the early days, exports involved simply boxing things up and moving them offshore. Now there are more complex mechanisms to generate wealth and, if that's the ultimate objective of Australian exports, then there are some areas and industry sectors that are far more profitable to Australia than others.

In trying to strike a balance between company returns and country returns, ultimately Austrade would be aiming to achieve country returns through the activities of companies. As a starting point, my paper took several different potential telecoms export areas and suggested the return to Australia is very much dependent on how those revenues are treated and on how the repatriation occurs. The question of where services are brought to account needs to be answered.

AC: *How would that apply to the manufacturing side of the industry?*

Knight: The manufacturing area was studied recently by McKinsey and the Australian Manufacturing Council [AMC]. Of those companies they looked at, the ones that had invested overseas in manufacturing plants had, in absolute terms, increased their exports from Australia.

It's obvious to anyone who works in this industry that it's very difficult to try and shore up your market position unless you're in a unique supply arrangement with a major distribution company. If you're looking at different manufacturing approaches, you need to position yourself within the markets where you are selling for reasons such as the cost implications associated with producing the product as well as the image that you have within that market. Just your presence

there adds value to trying to sell product. As the AMC said, that provides additional export returns to Australia, but the actual flow back to the country's wealth hasn't been fully evaluated.

AC: *When you talk of 'country returns,' are you including jobs and types of jobs?*
Knight: It's multidimensional. You have to talk about the immediate dollar implications of sales of services or products offshore as well as the flow-on intangibles to the community such as training, investment R&D, jobs and so on. In terms of the benefit to Australia, there is more than just the immediate dollar. There may be jobs if, for instance, the company has set up an offshore production plant for more commodity-type products and its reinvestment back in Australia is for the next generation of product. There needs to be a balance struck. From Austrade's perspective, we need to encourage companies to pursue their longer-term benefit. We also need to look at the flow-on effects back to Australia and make sure we have a strategy in place, not only in Austrade but in other areas such as Treasury, in terms of the company's financial treatment of revenues and returns.

AC: *Are you suggesting that a company's returns may never be seen back in the country of origin?*
Knight: There may be intangible benefits through the equity enlargement of the company itself or through skilled people transferred offshore who need to be paid. But it's not always clear where company funds are brought to account, and I think that probably changes on a case-by-case basis. It could involve a complex audit trail in some cases.

AC: *In areas such as the export of network construction and operation services or value added services and operational support systems, would you expect a divergence of company and country returns?*
Knight: Depending on treatment of revenues, country and company may be aligned. The divergence ultimately depends on the repatriation of profit and activities such as returns on management contracts or shareholder loans. It could also depend on whether another Government puts restrictions on the way a company gets a licence, in which case that country would benefit more via Australian company activities.

AC: *Whose responsibility is it to pay more attention to the financial treatment of corporate revenue flows?*
Knight: In many ways, with regard to export activities, it will come back to Austrade. There's a role we must play to ensure that we get the maximum return as a country and then balance that against company requirements. Within the context of the Telecommunications Export Task Force [TETF], we're looking at short term issues such as the industry mission [to Asia] and other other objectives with regard to promotion in the Asia Pacific as well as longer term issues. This is one of the longer term issues that has been tabled for discussion.

AC: *Presumably transfer pricing arrangements may be relevant. Will that require coordination with the Australian Tax Office?*
Knight: There needs to be an integrated approach. The 'one rule' which applies across different industries is not necessarily the best approach, given that globalisation is a major influence in some and not others.

AC: *What do you see as your major achievements since you joined Austrade?*
Knight: On a macro scale, we've seen the setting up of this new infrastructure with the Telecommunications Export Task Force, and the momentum it has gained. We also have seen the growth of the Telecommunications Export Development Group, which is now addressing the key issues. We're doing promotional work offshore, we're getting the companies in there, we're better briefing our posts so they're more aware of industry capabilities and opportunities. We have 73 offshore posts, and over 50 of those regard the telecoms and IT sectors as a priority.

On a micro scale, we've continued to work individually with a lot of clients, assisting them to win business. Because of the better reputation we're getting in returning value to them, we're tending to get more information flowing back to us on what business opportunities are available. We're then better positioned to feed as much of the industry into those opportunities as we possibly can and to get more involved with companies on an individual basis. There are quite a lot of different examples of that in the last 12 months. Our emphasis in the next 12 months will be more at a company-to-Austrade or consortia-to-Austrade level in order to win sustainable business internationally.

AC: *What role does Austrade play in the Telecommunications Export Task Force?*
Knight: When an inter-departmental committee last year recommended a Task Force to look at the key issues associated with the industry and its export goals, we resisted the opportunity to take either the chair or secretariat because we wanted it to be industry-driven.

AC: *But five of 12 or so members on the Task Force are from arms of government.*
Knight: Yes. But there's an equity there of Government and industry as representatives who are working together. What's driving the Task Force at the moment are the issues being raised by industry groups, in particular, by AEEMA's Telecommunications Export Development Group. When I arrived at Austrade, there were 15 or so people at the Export Group meeting I attended. The last meeting had 40 plus people there.

AC: *What issues have been raised by the Export Group?*
Knight: To date, it has had a fairly short term focus because there is so much to discuss such as the first major industry mission to Asia, image concern within the Asia Pacific region and so on. The industry was invited to choose priority markets, and then the original number of ten markets was reduced to three: China, Vietnam and Indonesia. We conducted a series of workshops at the meetings, discussing the relevant issues associated with companies entering those markets such as image, information and barriers. Out of this came the development of on-going country activity plans where objectives such as raising the industry profile or barriers to entry could be addressed in the context of the industry mission, in bilateral communications between governments or in a larger Asia Pacific forum.

AC: *Who is actually doing the work associated with implementing all these industry-defined issues?*
Knight: The workload responsibility has been delegated to different agencies. But the real practitioners, the companies, need to have their say on a lot of the issues raised and addressed within the Task Force.

AC: *It all sounds very bureaucratic . . .*
Knight: It's not. We've said: 'These are issues we're going to address, this is the forum in which we can address them, and these are the practitioners, the companies meeting on a monthly basis to discuss the issues.' These issues are simply taken back from the Export Group to the Task Force and then addressed in due course.

AC: *What role did the Task Force play in planning the industry mission to Asia which was the idea of the Export Group?*
Knight: The Task Force did have a role. It invited Communications Minister Beddall to several of its meetings and, at the Export Group's request, he agreed that he would like to lead a mission to Asia.

AC: *This obviously sent the Department of Transport and Communications into a flurry since it failed to turn up to your session at the IIR conference, apparently because it was too busy organising the mission.*
Knight: Obviously, with its Minister involved, it had a lot to do with ensuring the issues were correctly addressed. I can't really respond to that, because I don't know about their resource allocation.

AC: *Isn't there a danger that these new industry groups, including TIDA (the Telecommunications Industry Development Authority), will run around in overlapping circles?*

Knight: It might appear like that, but we've found it's the easiest way to get the exporters together to discuss issues. The alternative is on an individual basis, and we clearly don't have either the time or the resources for that. Essentially, we've established an infrastructure so the information can flow through from the exporter group. This can maximise outcomes through government and industry working together.

AC: *I note that one of the key export issues on the Task Force agenda is Australian Bureau of Statistics definitions. This should improve the industry forecasts floating around.*
Knight: Yes. It's important to gain accurate statistics. If the Task Force and Export Group are looking at the exportability of Australian industry to the region, then they need to know where they are starting and where they are going. The problem is that the forecasts are built on a shaky base. The Harmonised Tariff System picks up most details about equipment, but we don't measure services or software.

AC: *And what about trade in intellectual property?*
Knight: There again, these dimensions have to be taken into account to ensure we have a better picture. It becomes very complex if you add that extra dimension of whether revenues are flowing back to the country.

AC: *Are broadcasting and electronic publishing services part of your mandate?*
Knight: Not really. But every day that gets a bit closer because you're talking about another application of the communications area. So it's very grey around the edges.

AC: *Is another Austrade unit responsible for this area?*
Knight: Yes. There's a Business Development Unit looking at services per se including broadcasting. It's interesting that there was Government support in the recent Budget for a major services export study. That was an Austrade initiative to investigate that whole exporter area, given that we are in the top 20 of services exporters in the world.

AC: *Professor More from TIDA told the IIR conference there was a need to start the review of the industry post-1997. Do you agree?*
Knight: I think industry does want to know where the goal posts are set in terms of the rules that they have to work within.

AC: *Is the post-1997 environment a concern for Austrade?*
Knight: Most definitely. This is where some of the longer term industry issues have got to be addressed through the Export Group and Task Force. If you look at examples around the world where new policies have created enormous problems, then the domestic industry can be decimated.

AC: *Which examples are you thinking of?*
Knight: I don't think that it would be my role to mention them specifically.

AC: *What about New Zealand?*
Knight: It is one that has been raised in terms of the equipment supply area.

AC: *Are Australian companies disadvantaged when it comes to finding finance to support a bid for a big export contract?*
Knight: That's an area being addressed by Austrade right now, particularly in relation to the telecoms industry, which I don't think has taken advantage of a lot of the finance available in the context of the World Bank, the Asian Development Bank and so on. There are few examples where companies have actually won anything outside our own aid programs. Telecommunications gets a pretty good run with the amount of DIFF [Development Import Finance Facility] money that is available because of the infrastructure component in developing nations.

> *"One of the worst scenarios is when a State leads a mission of companies offshore, and we don't know anything about it at a Federal level . . . it makes us look as if we have no idea about how to work together as a country."*

AC: *The State Governments are also involved in providing support services for exporters. Do they overlap with Austrade?*
Knight: State Governments can add a lot of value. We talk as much as we can within both the IT and telecoms area. I think it's more a question of trying to get better coordination at a Federal and State level.

One of the worst scenarios is when a State leads a mission of companies offshore, and we don't know anything about it at a Federal level. So you have situation where one mission is visiting a country one week, and the same industry group appears in another mission the following week. From our perspective, it's a duplication of resources but, even worse, from the perspective of our trading partners, it makes us look as if we have no idea about how to work together as a country. In Asia, they can't see State rivalries as we can see them.

AC: *Austrade received negative publicity following the recent ITU conference in Singapore. Would you comment on that?*
Knight: You can't look at one conference in isolation from a total industry program. Whilst we didn't have a stand at that conference, quite a significant number of Australian companies were there seeking out business, and there was a lot going on behind the scenes.

We actually had Andy Fung, our specialist telecommunications trade commissioner from Hong Kong there. In the context of the Export Group, we've begun to look at all the trade shows in the region in the next two or three years and which ones we will focus on as an industry group.

AC: *Why have you established a specialist trade commissioner for telecommunications in Hong Kong?*
Knight: There is a group of companies cofunding that initiative with Austrade which is addressing the three China markets. It has been created to ensure potential customers in the region are being serviced by an Austrade industry specialist, who also works closely with our network of overseas posts. This means that Austrade is bringing both geographic and industry expertise to our Australian clients.

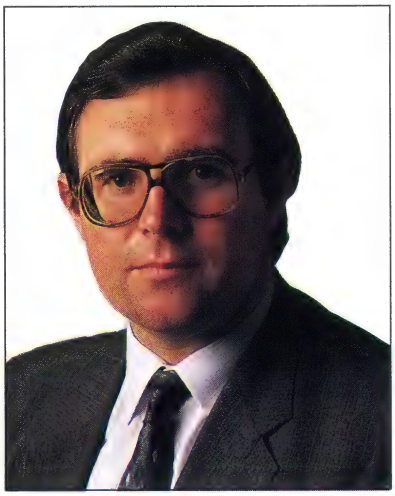
AC: *Do other Australian companies still get support there through Austrade?*
Knight: Most definitely. They also get the flow-on benefits from his presence in those markets. Through working on behalf of his clients, he's turning up opportunities that are being fed into the network.

AC: *Is Austrade going to apply this model to other markets?*
Knight: It could potentially be used where it has the full support of industry to work with us in a commercial partnership.

AC: *Do you think the initial enthusiasm of the Task Force and Export Group will fade? Will there be less need for them eventually?*
Knight: You mean will we do ourselves out of a job?

AC: *I guess you could always revamp them in some other form! But is the enthusiasm you have observed in the Task Force and Export group because they're relatively new?*
Knight: They're right for now. People are saying they need the infrastructure now so they can address issues and get them dealt with. If that infrastructure is well established, it will start to operate as a matter of course, in which case the effort will be less, and we'll be looking to the next stage. From our perspective, we want to see a lot more business for our telecommunications companies, so we're setting up an infrastructure for the industry to get to that next stage. We're looking to capitalise on all the work we've done to date, and we're expecting those activities will create significant new business opportunities in the region. That's our goal over the next 12 month period.

Liz Fell is a freelance journalist based in Paddington (NSW).



Tom Amos

A Question of Balance

Trying to unravel the maze of pricing options that have appeared since competition started has been daunting in the business world, what with SPAs, Horizon, FlexiPlans and Advantages, to name just a few of the many discount arrangements that have sprung from the minds of various marketing departments. Some of the finer points are, of course, under challenge between the two main protagonists in places outside Austel, and will be decided by non-technological wisdom.

In the more mundane but still highly competitive consumer telecommunications area the recent introduction of unit fee radial call options by Telecom has some interesting sidelines that may create a precedent for other such services. The bundling of a flat distance fee that reflects both the distance and bandwidth component of providing a call is an interesting tariff option, as it appears to target and only apply to those who live on the edge of major unit fee call boundaries and almost nowhere else — great if you can get it, but what about the bush?

Now the question comes down to who would use such an arrangement and why? If you live in the urban areas that surround the two main cities of Sydney and Melbourne, and your calling pattern is such that your main area of calling is across a charging boundary into the large unit fee area of the main city, then it could be economical to take the fixed fee untimed option rather than pay the Community Call rate that currently applies to a call fee per three minutes. Thus calls to the CBD would be charged at a flat rate, but calls locally would also be at the same rate.

The further from the call boundary/city boundary the customer lives, the less attractive the plan is likely to be, as the 75km radial distance and zone of business tend to concentrate around the 10 to 15km area. Thus the customers who could benefit would be those who live on the immediate fringe, and there could also be some benefit if long-duration calls or a large number of calls are made.

Benefits of tariff innovation that flow to users are positive outcomes of the changes that the industry is currently undergoing. The introduction of radial distance charging, new unit fee boundaries and bundled short haul STD cost structures into an untimed call seems to be a trial for a whole new charging regime that is no longer tied to the current boundaries and zones currently defined across Australia.

Since the late 1970s there have been numerous studies that indicated to Telecom that it was underpriced in the short haul service area viz. the Customer Access Network (CAN), and vastly overpriced in long-haul areas like Sydney to Melbourne trunks.

The balance between long and short haul carriage has essentially remained, although the majority of price rises until the introduction of formulas and competition have been limited to the CAN component. The unit fee tariff option changes the balance of long haul and short haul by encompassing some of the long haul component in the untimed short haul charge, extending the traditional 16km unit fee arrangement to a 75km radius. It is claimed by Telecom to be revenue-neutral in the target areas, indicating that there would a redistribution of savings in the zones of interest only.

What is interesting is the concept of a unit fee call that extends past the already established boundaries. Of course, the 220-odd charge zones that exist have existed for some years, and a number of rulings and commercial arrangements and CSO obligations have been developed that utilise the zonal system and corresponding boundaries, not the least of which would be the Optus network and interconnect arrangement to pick up and deliver traffic via the CAN. Rebalancing the mix of long and short haul and increasing the unit fee areas seems to be going in a direction that could disadvantage the resellers and the second carrier by bundling the access mechanism and making it seemingly non-cost related. All access calls to a long distance carrier would of course be restricted by the bundling effect . . . and would probably be a matter for the TPC at some future time.

Bundling across multiple charge zones which were originally utilised to determine interconnecting points per short haul trunks makes it difficult to ascertain whether there is a potential extension or not for such services. As it currently stands, interconnect across more than a charging boundary constitutes practical erosion of the carriers' rights. With the new boundaries of 75km radius this obviously extends what would be classed as practical erosion to 150km.

Extension of the concept to unit fee calls across Australia is a goal that could now be readily achieved if the 35c unit fee call were adopted. It is well known that excess long haul capacity exists between all the major cities and the capital cost of provision of the service is, in most cases, less than the cost of the local CAN access. Given that the utilisation of these long haul trunks is tenfold that of the average CAN, it is easy to derive that a community unit fee call of 50c over a 750km radius is within the realms of extrapolation based upon the 35 cent option.

What a problem — radial charging from the point of origin and a flat unit fee option for a 750km radius! This is rebalancing the long haul and short haul par excellence — great for the users . . . not so great for the competitors.

The tenfold increase would not have a corresponding tenfold increase in charges. Where does that leave the competing carriers? It certainly underlines the inequality that can evolve when left unchecked.

Balance in tariff rates is always difficult when the tariffs are not based upon real costs. With a plan potentially targeted for every telephone, there is now the potential to undermine the intent of the 1991 Act, which was clearly structured to stop the dominant carrier offering selective vertical discounts to eliminate the competitors. The concept of unnecessary duplication seems also to have evaporated. Oh well, it is only a question of balance!

Tom Amos is a partner with telecommunications consulting engineers Amos Aked Swift.

Dr Terry Cutler

Supply-Side Restructuring: Pain or Opportunity?

At the moment a new factory or facility seems to be opened every week. Some plants appear to have been opened several times (collecting plaques faster than Hollywood Boulevard collects stars' hand prints). Telecom's overdue push to restructure its supplier relationships has coincided — happily — with a good hard look at how it goes about manufacturing and supplying networks. Worldwide, both equipment manufacturers and telcos are going back to basics in examining their business systems and industry relationships.

The key words for all this industry change are convergence, world factories, and borderless markets. In the telecommunications industry we often tend to be very parochial about the drivers for change. We like to argue that telecommunications and information technology are special and different — and hence the need for industry-specific regulation and policies — often at the expense of recognising that the problems facing the industry's large corporations are the same challenges confronting any large corporation today. Here the code words are 'process re-engineering,' 'virtual corporations,' and 'strategic alliances.'

Unfortunately, it is much easier to have armchair chats about global industry trends than handle some of their practical implications on the ground or factory floor. Two different responses to industry changes are evident. The first looks at change as an opportunity for innovation. The second defines change and rationalisation as something painful, with a lot of downside to be measured in terms of jobs. In my view, Telecom's current supply review and its associated rethinking on network architectures is timely and courageous. Unfortunately, these endeavours run the danger of being derailed or mangled by the industry politics that masquerade as industry policy debate.

We no longer operate in an industry where there are clean handoffs from hardware supplier to the carrier builder of networks. The market pressures from end users, and the growing competition in delivery of user applications, are forcing equipment manufacturers and carriers into new, more collaborative and risk sharing relationships.

As companies re-design their business systems — changing the way they do research and development, redefine their product in terms of 'intellectual property,' or institute manufacturing franchises linked as 'world factories' — the strategy for most companies is to do anything to keep or boost country market shares until some of the competitors pack up and go elsewhere.

There is a strong argument that Australia has too many market participants and too much installed capacity for the size and future growth rates of the local market. In my view, little of the installed capacity is capable of being re-badged as world factories. The same vendors operating here are busily building those elsewhere.

Telecommunications manufacturing markets are changing fast, from metal bashing to 'knowledge factories.' There is a growing differentiation between high volume, commodity production for mature product lines, and low volume, high value production for innovative market niches in advance of product commoditisation. More and more of the production process is being unbundled, with more and more specialised chip or software components being brought in, and multi-sourced.

Meanwhile, one of the new Telecom buzz words is 'Future Mode of Operation' studies. This is about the redesign of basic network architectures and operating systems to create better market value from network capital injections. The key here is to exploit the full benefits of new network functionality and flexibility; this requires breaking out of the straitjacket of traditional, hierarchical network platforms. For Telecom this is essential for three reasons. First, to get better value out of increasingly scarce capital funds. Secondly, to become cost competitive with the 'green field' networks of competing carriers like Optus and the prospect of a growing number of value added resellers. Finally, to accelerate the implementation and delivery of new intelligent network applications built around specific user segments.

Re-engineering the processes for building networks creates numerous opportunities. It enables the carrier to rethink the traditional partitioning of activity between itself and suppliers, with the opportunity for greater use of turnkey installation, contract services for the whole of plant life, and joint applications development. Traditionally, we conceptualised and managed networks in terms of the mix of transmission, switching, and terminating plant. In future networks, complex new network management systems and operating systems will become an increasingly important and dominant element of network design and supply requirements.

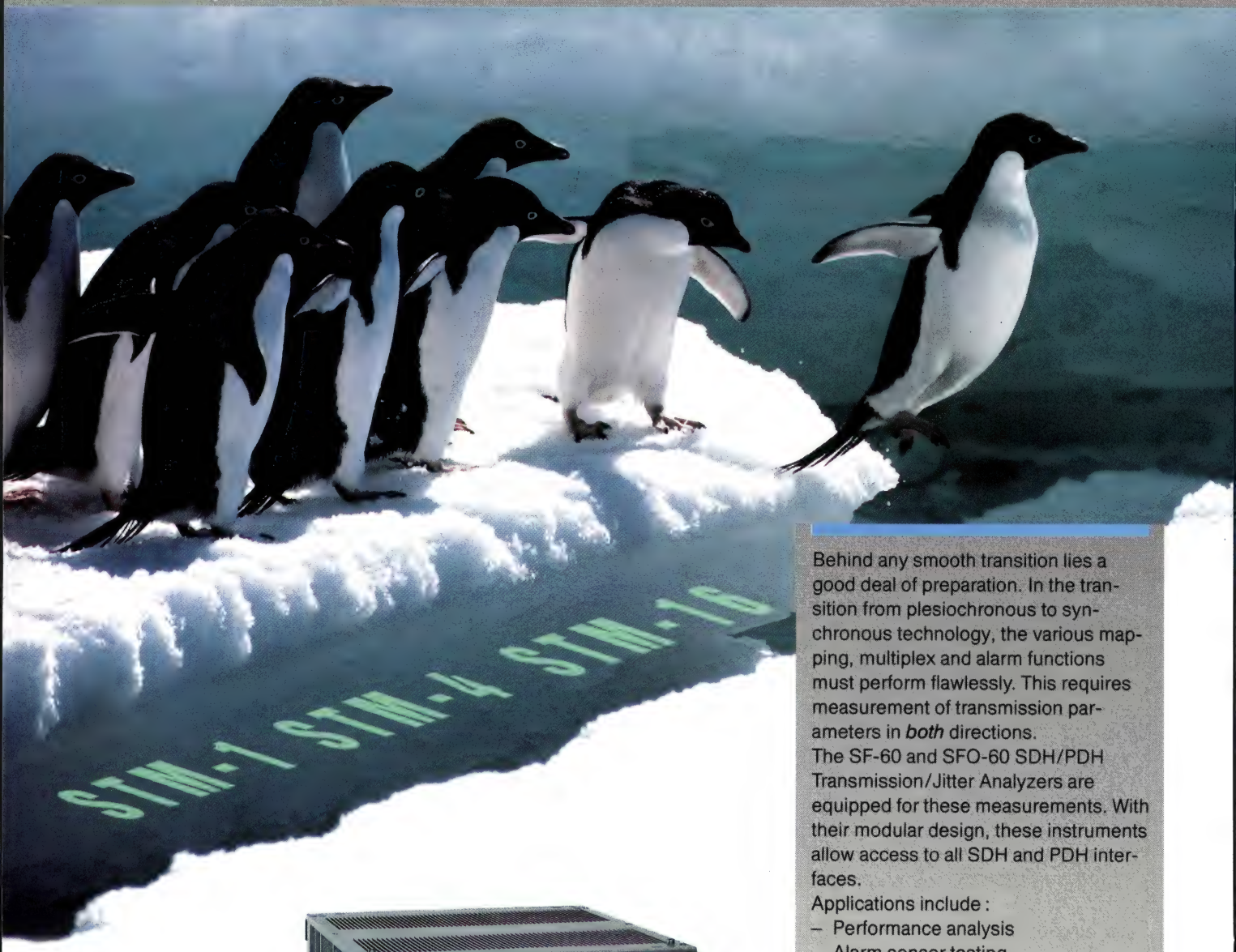
As a monopoly carrier, Telecom traditionally operated with a limited number of suppliers of switching and transmission equipment, who traded large local investment for the prospect of large, long-term contracts. From the start of the 1980s, Telecom's supply policies changed. Competitive, shorter term tendering was used in an attempt to get better prices from suppliers, and to improve delivery lead times.

The proliferation of new business communications also provided the opportunity to encourage new entrants for the supply of special networks. This swing of the supply policy pendulum resulted in a proliferation of suppliers and a fragmentation of the market. As Telecom now enters a new era of network competition, more sophisticated approaches to managing supply-side relationships are needed.

As the life and death lobbying over Telecom's contracts hots up, and as more factories are re-opened and more programmes relaunched or re-packaged, the harder it will be for Telecom to manage the politics of change. It would be a pity if Telstra is forced to go back to yesterday's future.

Dr Terry Cutler is Managing Director of Cutler Consulting, and is based in Melbourne.

Making the leap



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Rating FDDI Bridges and Routers

After a protracted gestation period, FDDI internetworking gear has now got what it takes to deliver much-needed bandwidth to overloaded Token Rings and Ethernets.

Now that network managers have seen for themselves that Ethernet and Token Ring don't have the bandwidth to make it on the backbone, they face a simple choice: field complaints from angry users on maxed-out LANs or find a technology that can really deliver. Industry gurus may sing the praises of ATM, Fastpac, and fast Ethernet (often changing their tunes with each new vendor endorsement), but they seem to be oblivious to the one high-speed scheme that boasts a full range of readily available networking products. That technology is FDDI.

True, the fibre distributed data interface doesn't get much respect these days. But FDDI, which has been around for close to five years, has quietly matured into a stable transport method that's more than capable of handling LAN backbones. (For a complete discussion of FDDI, see 'An FDDI Primer' on page 72).

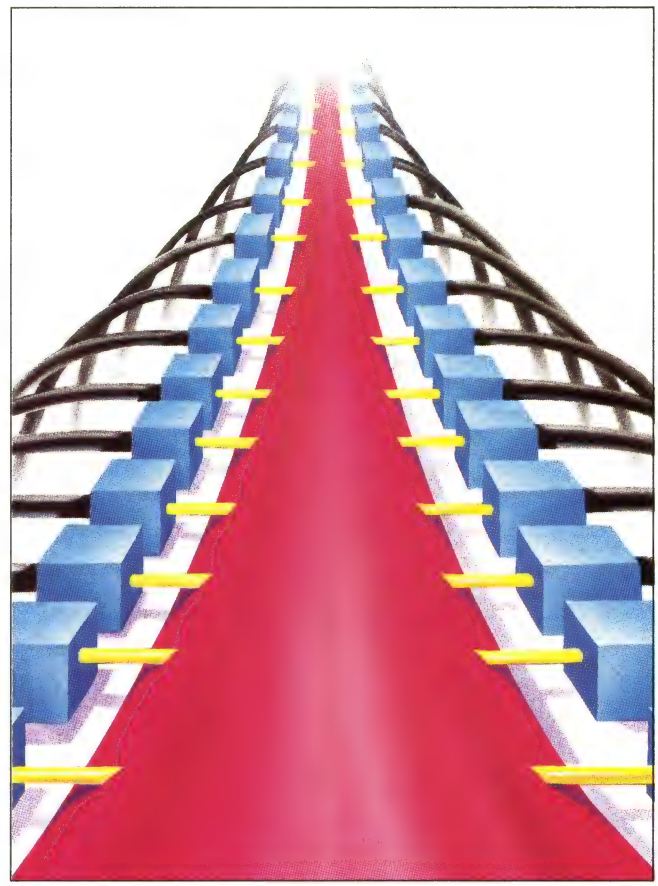
FDDI's biggest claim to fame is its 100Mbps throughput (a real, rather than a theoretical, limit). But bandwidth on the backbone doesn't mean much if departmental LANs can't exploit it, so the Data Comm Test Lab put together the industry's first evaluation of the bridges and routers that tie local networks into an FDDI ring.

In essence, the Lab was looking to answer one critical question: How many LANs can a bridge or router link to an FDDI backbone? To find out, it put six FDDI bridges and routers from five vendors through their paces. (The Lab invited the industry's top 10 market leaders to participate.) Each product was tested in Gatling gun fashion, using a variety of protocols and packets.

When the smoke cleared the results were tallied (with some cause for celebration). The FDDI bridges and routers evaluated, while not perfect, generally have enough horsepower to move traffic from the backbone to as many LAN segments as vendors claim they can handle. In some cases, the products even pass traffic at close to the wire speed of each attached LAN.

Of the boxes evaluated, two deserve particularly high praise. The Backbone Concentrator Node (BCN) from Wellfleet Communications was the overall leader in this round of tests. For its high routing throughput, support for large numbers of LAN segments, and superb bridging numbers, the Lab is pleased to award a Tester's Choice to the BCN. The LinkBuilder 3GH from 3Com also earned a Tester's Choice. The LinkBuilder, a bridging hub, is a real speed demon, sending traffic at near wire speed for all attached segments.

In addition to the Wellfleet BCN and 3Com LinkBuilder, the Lab checked out the 3Com NetBuilder II router, the DECnis 600 bridge/router from Digital, a hybrid PC-based router supplied by Madge Networks, and the CNX 500 bridge/router from Proteon.



The Madge and Proteon devices were configured to link FDDI networks to Token Ring LANs; all other vendors supplied Ethernet and FDDI interfaces. (Wellfleet and 3Com also offer Token Ring; Proteon has an Ethernet interface. The Lab tested the products that best represent each vendor's chief area of expertise.)

To understand why the winners performed as well as they did — and what areas still could use improvement — it's helpful to understand some of the criteria used in these evaluations. The most

Selected Vendors of FDDI Bridges and Routers

VENDOR	PRODUCT	SOFTWARE RELEASE	TOPOLOGIES SUPPORTED	NUMBER OF SLOTS; MAXIMUM INTERFACES PER SLOT
Digital Equipment Corporation (02) 561 5252	DECnis 600	2.2	Ethernet, FDDI	7; 2 Ethernet, 1 FDDI (2 slots), 8 sub-E1 WAN, 2T1/E1, 1 T3
Madge Networks DPP (03) 694 6711	Madge adaptor cards and Novell Multiprotocol Router software in Compaq SystemPro	Adaptor drivers: 1.04a; Novell MPR: 2.0	FDDI, Token Ring	7; 1FDDI, 1 Token Ring
Proteon (02) 955 8555	CNX 500	13.0A	Ethernet, FDDI, Token Ring	3; 2 Ethernet, 1 DAS FDDI, 2 Token Ring
3Com (02) 959 3020	LinkBuilder 3GH	2	Ethernet, FDDI	11; 8 Ethernet, 4 FDDI
	NetBuilder II	6.1	Ethernet, FDDI, Token Ring	4; 1 Ethernet, 1FDDI, 1 sub-T1 to T1/E1, 1 E1
Wellfleet Communications (02) 959 1290	Backbone Concentrator Node (BCN)	1.55	Ethernet, FDDI, Token Ring	13; 4 Ethernet, 1 FDDI, 4 Token Ring, 1 sub-T1 to T1/E1, 1 T1, 1 E1

DAS = Dual-attached station

important of these are performance, configuration, cost, and network management.

Peak Performance

Performance was the key criterion in this round of tests. FDDI networks can carry traffic at nearly 100% of their 100Mbps capacity. Thus, an FDDI ring can flood 10 Ethernets running at 10Mbps or seven Token Ring LANs running at 16Mbps — provided the intermediate bridge or router can handle such a load. Obviously, the faster a device is and the more attachments it can handle, the better it's suited to backbone applications.

But there's more to performance than just traffic: the type of traffic involved and product scalability also must be factored in.

Because bridging is less complex than routing, bridged traffic should theoretically pass through a device faster than routed traffic, but that isn't always the case. DEC's device routed 64-byte IP packets faster than it bridged 64-byte frames — an indication that net managers shouldn't take anything for granted when trying to pick the best tool for the job.

Scalability — the ability to add interfaces — also affects performance, particularly in high-capacity bridges and routers. When a device has to service five or 10 LANs, its throughput can fall off and stability can be compromised. In an attempt to eliminate these problems, some vendors add processors along with interfaces to make sure the load is shared equally.

To assess the effect that added interfaces have on throughput, the Lab evaluated the DEC and Wellfleet routers with six Ethernet interfaces, and then again with 10 interfaces. (These were the only two routers tested that could handle the higher number of interfaces).

The Configuration Question

Configuration was judged to be almost as important as raw throughput. Mixing FDDI with Ethernet or Token Ring can make internetworking more difficult than it already is. Several vendors made repeat visits to the Lab to tweak their devices, and more than one muttered "it's not supposed to do this" in response to unexpected conditions.

Routers, as in past tests, required extensive configuration and tuning to operate properly. IP and IPX had to be enabled and other protocols had to be disabled for each LAN segment. In the case of Wellfleet's BCN, the changes had to be made on a port-by-port basis. The Lab also had to pick a common routing method — in this case, RIP (routing information protocol), rather than OSPF (open shortest path first). Further, IP routing required support for SNAP (subnetwork area protocol), which defines how packets and ARP (address resolution protocol) messages are handled when travelling across an internetwork. And even with all these parameters, the test bed represented a relatively simple internetwork. Complexity grows as more protocols must be accommodated.

The one device supplied with a graphical interface — Wellfleet's BCN — was actually the most difficult to configure. 3Com, which uses command-line interfaces, had remarkably straightforward configuration routines, despite the many options available. Obviously, graphical doesn't always mean great.

FDDI itself adds further complexity for Token Ring users. The technology accepts transparently bridged traffic — the most common type on Ethernet LANs — without the need for any conversion. But the FDDI spec doesn't spell out how to handle source route bridging (SRB) traffic — the most common type on Token Rings. Some vendors have simply adopted the source routing transparent (SRT) spec spelled out in IEEE 802.1d; others have come up with proprietary schemes. Some approaches add overhead; many are incompatible. Proteon, for instance, encapsulates SRB traffic in frames that are transparently bridged across an FDDI backbone.

Cost also is an important consideration. FDDI interfaces are still significantly more expensive than their Ethernet or Token Ring counterparts. And backbone bridges and routers are often among a vendor's most expensive boxes. Madge Networks has a novel low-cost alternative — a high-end PC configured with FDDI and Token Ring adaptors from Madge and routing software from Novell. But at this point, the Madge box doesn't offer bridging. When it comes to throughput, the Madge box delivers lower per-port data rates than Proteon's CNX 500 (the only other Token Ring router tested), especially for IP traffic. Still, Madge's solution may be attractive when cost is a big concern. What's more, Madge's approach may open up the FDDI market to other PC-based schemes and cause vendors of proprietary boxes to rethink their prices.

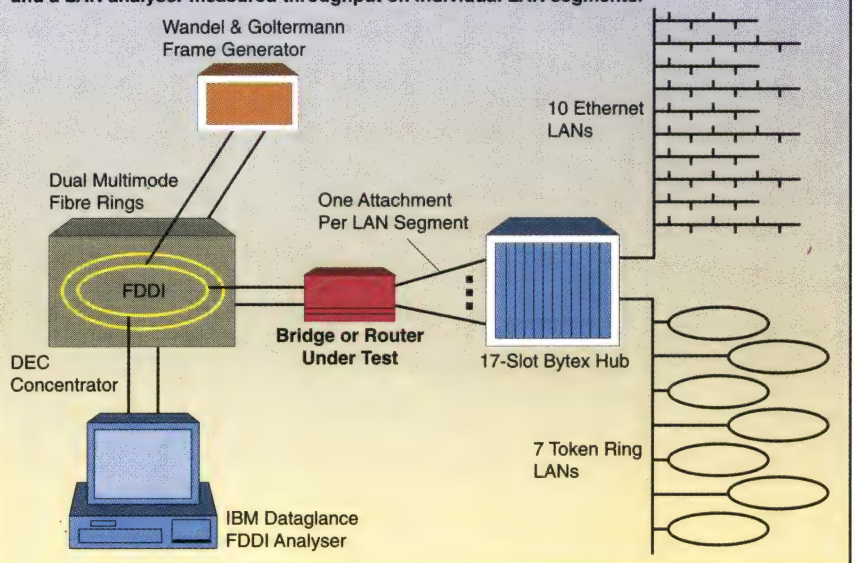
The Test Bed

Essentially, the performance part of the test sought to send as much FDDI traffic as possible onto as many attached LAN segments as possible. The test bed comprised three main components: an FDDI ring, the

ROUTING PROTOCOLS	BRIDGING METHODS
IP, IPX, DECnet Phase IV, OSI, AppleTalk, Integrated IS-IS	802.1D spanning tree, transparent bridging
IP, IPX	None
IP, IPX, XNS, OSI, DECnet, VINES, AppleTalk	Transparent spanning tree, source route
Not applicable	Transparent spanning tree
IP, IPX, XNS, OSI, DECnet, VINES, AppleTalk	Not applicable
IP, IPX, XNS, OSI, DECnet, VINES, AppleTalk	Transparent spanning tree, source route

Figure 1: The Test Bed

In order to stress test bridges and routers, the Lab linked an FDDI network to multiple Ethernets and Token Rings. A frame generator on the FDDI network sent traffic at 100Mbps, and a LAN analyser measured throughput on individual LAN segments.



router or bridge under test, and the attached LANs (see Figure 1). Test traffic was sent from a frame generator on the FDDI network to a PC on each of the LAN segments. The Lab initially offered 100% of FDDI capacity to the bridge or router. Since it didn't expect all the products to be able to work at 100% of offered load, the Lab also measured throughput at 50%, 10%, and 5% of full capacity.

The Lab used a DA-30 analyser from Wandel & Goltermann running Version 3.3.4 of W&G's FlexmitF software to generate traffic. By generating void frames, FlexmitF makes it possible to throttle back on the number of valid data frames sent to the bridge or router. The test traffic was sent using a Gatling gun approach: The first packet was destined for segment 1, the next for segment 2, and so on.

To decode traffic, the Lab used an IBM Dataglance, an FDDI-only analyser that consists of cards and software that can be added to a high-end PS/2. The Dataglance was employed to verify the contents of test frames, check ring status, monitor FDDI utilisation, count packet rates, and measure overall throughput. A concentrator linked the frame generator, FDDI analyser, and device under test to the FDDI ring. The Lab used a DECconcentrator 500 from Digital for this purpose.

Heavy Traffic

Because FDDI can carry close to 100Mbps, seven Token Rings running at 16Mbps and 10 Ethernets operating at 10Mbps were attached to the backbone. The theoretical aggregate limits of these segments are 96-Mbps and 100Mbps, respectively. One PC was attached to each LAN segment. The Token Ring PCs used 16Mbps adaptor cards from IBM, Madge Networks, and Olicom, while the Ethernet PCs used Etherlink III adaptors from 3Com. The Lab used a Series 7760 Switching Hub from Bytex to link the 17 LAN segments that had been established to the backbone.

Each LAN segment had three attachments: the router or bridge, a PC, and a frame counter that the Lab moved from segment to segment. To measure throughput on the Ethernet/Token Ring side of the test bed, the Lab used a Network Advisor from Hewlett-Packard, and double-checked its results with a Sniffer analyser from Network General.

To simulate three of the most common real-world traffic patterns, throughput tests were conducted using IP and IPX routing and transparent bridging. Support for both IP and IPX was enabled in all the routers tested; bridging was disabled during routing tests to isolate routing performance, and vice versa.

To measure IP throughput from FDDI to Ethernet, the Lab attempted to send custom-crafted test packets of 64, 1,024, and 1,518 bytes from the FDDI network through the router to each LAN segment. For Token Ring, the Lab increased the largest packet size to 4,096 bytes — close to FDDI's theoretical maximum of around 4,500 bytes. (The Lab built these packets from scratch rather than using application traffic. Data consisted of a string of zeros; destination and source address and interframe delay were varied for each test. For the record, the terms *frame* and *packet* refer to the same thing: a discrete amount of data. Bridged traffic is generally referred to in frames, while packets are more common in routing parlance.)

To measure IPX throughput on Ethernet, the Lab sent packets of 64 and 512 bytes through each router. For Token Ring traffic, the maximum packet size was increased to 4,096 bytes. Transparent bridging tests used minimum and maximum frame sizes: Ethernet segments received 64 and 1,518-byte frames, and Token Ring segments received 64- and 4,096-byte frames.

The Lab started all throughput tests with 100Mbps offered load on the FDDI side. In some cases, products could not pass traffic under these conditions. Madge's product, for example, would only route 4,096-byte IP packets when the FDDI load was throttled back to 10%. (In all cases, when an FDDI load of less than 100% was used, that has been indicated.) What's more, some products actually worked faster with 50-Mbps coming in than with 100Mbps. This isn't surprising, since input overload often degrades performance. For example, Proteon's CNX 500 bridged 64-byte frames 50% faster when the FDDI load was throttled back to 50%.

Test Results

It's simple to assess the results for IP and IPX routing over Ethernet: Wellfleet and 3Com turned in very similar numbers for IP (see Figure 2 on page 70). Wellfleet's BCN was always the winner for IPX (see Figure 3). DEC, the only other vendor in the Ethernet IP and IPX routing tests, finished third with all three packet sizes.

To ensure a fair comparison, IP routing tests for DEC, 3Com, and Wellfleet were measured with one FDDI and six Ethernet interfaces (six is the maximum number supported by 3Com's NetBuilder II). Because Wellfleet and DEC support 10 Ethernet in-

Figure 2: IP Routing, FDDI to Ethernet

Six segments total, measured on single segment

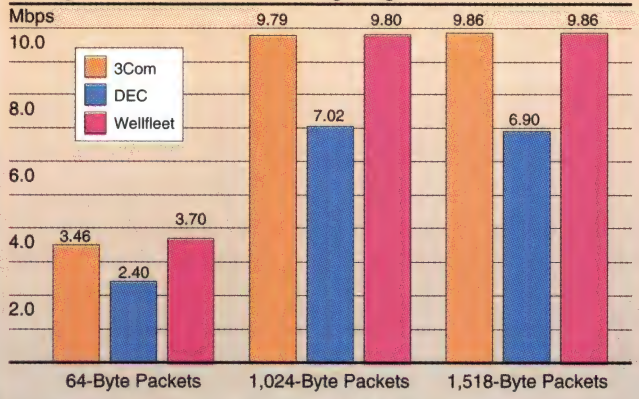


Figure 3: IPX Routing, FDDI to Ethernet

Six segments total, measured on single segment

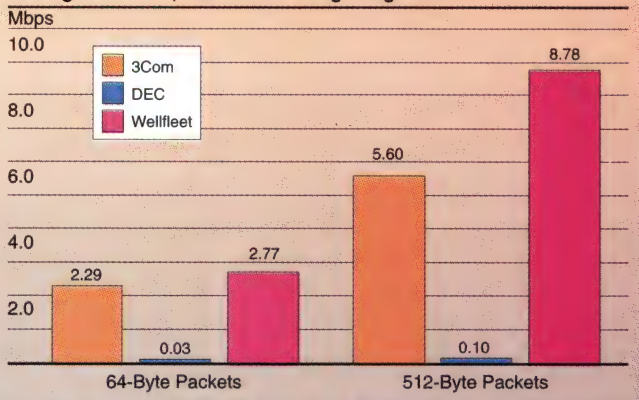


Figure 4: Transparent Bridging, FDDI to Ethernet

Six segments total, measured on single segment

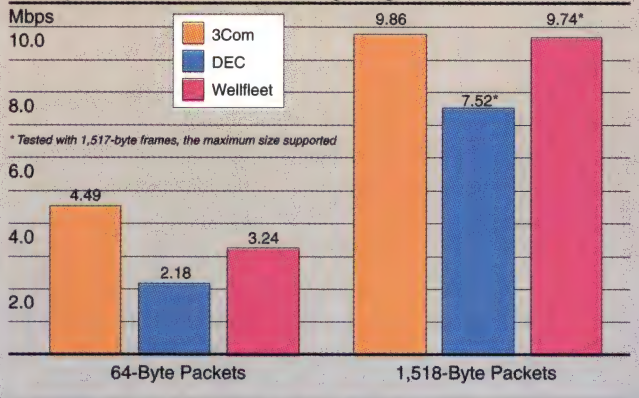


Figure 5: IP Routing, FDDI to Token Ring

Five segments maximum, measured on single segment

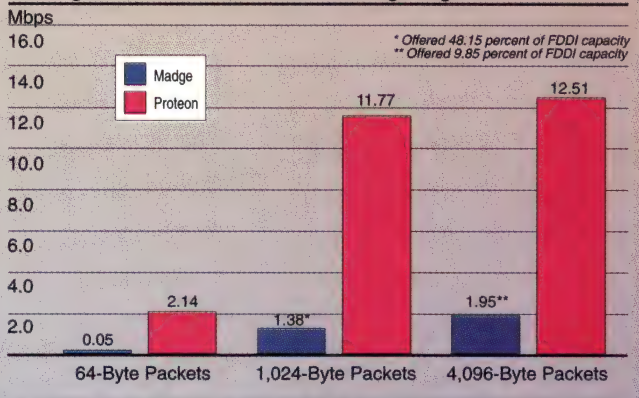


Figure 6: IPX Routing, FDDI to Token Ring

Five segments maximum, measured on single segment

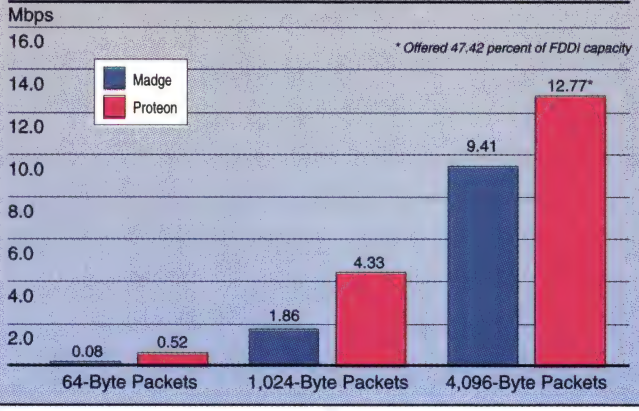
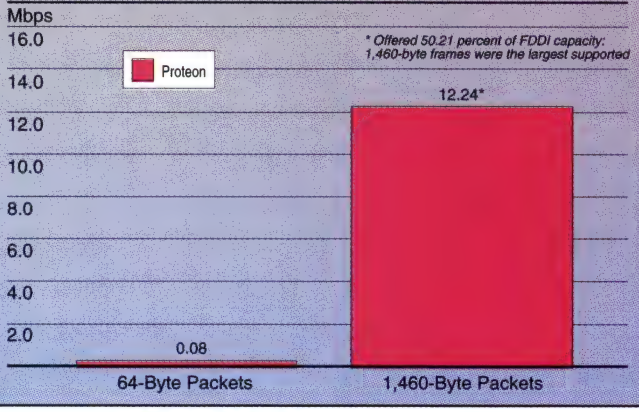


Figure 7: Bridging, FDDI to Token Ring

Five segments maximum, measured on single segment



terfaces, the Lab also ran the throughput tests with both products equipped with that number of adaptors. Wellfleet's throughput was lower with 10 Ethernets attached. IP routing with 64-byte packets fell to 2.18-Mbps on each attached LAN — a decline of nearly 60% from 3.46Mbps with six Ethernets. Degradation at larger packet sizes was less pronounced with 10 segments: the BCN routed 1,024-byte packets at 8.42Mbps on each segment, compared with 9.80Mbps per segment with six segments attached. For 1,518-byte packets, performance with 10 segments dropped to 8.96Mbps per segment, compared with 9.86Mbps per segment with six Ethernets.

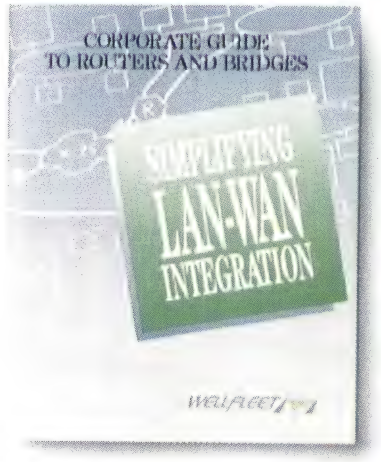
With 10 Ethernets attached, the DECnis 600 routed 640-byte IP packets at 2.40Mbps (per segment) — the same rate it posted with six segments. Similarly, results for 1,024- and 1,518-byte packets varied by less than 10Kbps. As noted, DEC's software is not optimised for IPX traffic, a shortcoming the vendor plans to remedy by year's end.

It's easy to see why performance was better with fewer interfaces. With 10 interfaces in place, each port on the bridge/router was offered 10Mbps. When six interfaces were slotted in, each port was offered 15Mbps. In almost every case, performance with six adaptors was better. The bridge/routers dropped more frames but they also pushed more frames through.

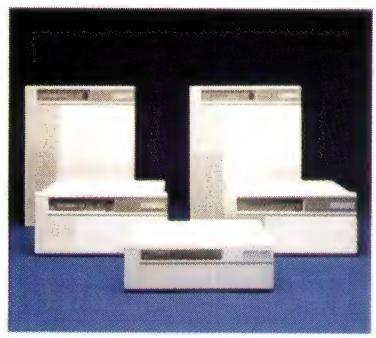
Ethernet bridging was an easy call: 3Com's LinkBuilder 3GH took the top slot (see Figure 4). With 64-byte frames, the LinkBuilder beat Wellfleet's BCN by more than 1Mbps and the DECnis 600 by more than 2Mbps. With 1,518-byte frames, the difference was less extreme: 3Com surpass-

Continued on page 74

You've Really Got To Hand It To Any IS Professional Who Wants To Understand LAN/WAN Integration



After all, internetworking can be a challenging subject - especially when it's not your primary focus. Fortunately, Wellfleet has produced a comprehensive guide that removes the mystery from internetworking. The guide is perfect for anyone who wants to gain a more thorough understanding of routers and bridges, Communications protocols, internetwork design and cost-justification, and selection criteria. For more information and a free copy, — **phone Jennifer Cole today, on (02) 959 1290.** Whether you're an internetworking expert or novice, it's sure to come in handy.



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An FDDI Primer

Network managers have good reason to be worried. They're already starting to run out of bandwidth on their backbones, but ATM — the solution most often suggested — is still more hype than help. Let's get real: FDDI (fibre distributed data interface) is here today, and at 100Mbps it's got the bandwidth to accommodate multiple LAN types, servers, and clients (see Figure A). And what's more, since this token-passing scheme is implemented with dual fibre optic rings, it's highly fault tolerant.

On the downside, though, there are some interoperability issues that must be ironed out. Right now, the FDDI standards from ANSI (American National Standards Institute) and ISO (International Standards Organisation) do not address source route bridging, which opens the way for proprietary (hence incompatible) schemes. What's more, FDDI network adaptors don't always work as well as they should with popular network operating systems.

A sizeable part of today's bandwidth crunch can be traced to conventional wisdom, which typically assumes that backbones needn't be much faster than the feeder LANs they join. After all (so the reasoning goes), a single LAN is generally running only at 10% to 20% of full capacity. Ironically, advancements in bridge/router technology have exacerbated the situation. Formerly, bridge/routers slowed the flow of data between LANs (unintentionally, of course) because of inherent frame-handling limitations or excessive latency. Now that some vendors offer wire-speed boxes, bridge/routers no longer act as throttles.

New applications on the way are only going to make things worse. Character-based applications used for word processing and inventory control are fast becoming more powerful. LU 6.2 applications, increasingly common in many corporations, can easily transfer data across a 16Mbps Token Ring at close to wire speed. Further, it's already obvious that the just-released NetWare 4.0 can easily saturate Ethernet or Token Ring. And when multimedia gets here, it's going to hurt. A single, uncompressed, black and white document scanned at 300 dots per square inch will yield a 1Mbyte binary file. Scanning in a colour image could create 10 times as much data.

If all this sounds familiar, then it's time to turn to FDDI for the answer.

FDDI Always Rings Twice

A LAN is only good if it's robust. Ethernet and Token Ring — if implemented perfectly — are very reliable. Still, only a single cable connects even the most important station or server to the LAN. If that cable goes, the node is down. FDDI, in contrast, is designed to be far more fault tolerant. As mentioned, a network actually consists of two rings (as does 802.5 Token Ring). If a fault occurs on the primary ring, the technology automatically 'wraps' the primary ring onto the secondary ring, bypassing the fault. In essence, wrapping detours the traffic around the problem.

Wrapping is only available with a dual-attached station (DAS) or a dual-attached concentrator (DAC), each of which is physically linked to both rings.

The drawback to this approach is that if more than one dual-attached node is turned off, entire sections of the FDDI ring are isolated and cannot communicate. Thus, dual attachment should only be used when nodes are rarely going to be powered off. Routers and servers, for instance, are good candidates for dual attachment; client PCs are not. (It's possible to install optical bypass switches in dual-attached nodes that shunt the signal past the station when the power is off. These switches tend to be expensive, however, and may reduce network performance).

The other way to link to FDDI is via a single-attached station (SAS) or single-attached concentrator (SAC). These are physically connected to only one of the rings, through a user port on a concentrator. When a single-attached node is turned off, the concentrator merely bypasses that port. Single attachment isn't fault tolerant, but it's the way to go with stations that are frequently turned on and off.

FDDI's fault tolerance doesn't stop there. Network managers also can take advantage of the fact that an individual FDDI network interface card in a bridge, router, or server can be simultaneously linked to two FDDI concentrators (see Figure B). This feature, which is not very well known, is called dual homing. It establishes an active connection as well as a hot standby that's automatically activated in the event of a failure.

Dual homing can be implemented using any dual-attached FDDI adaptor. The beauty of the scheme is that it's implemented at Layer 1 (the physical layer). Thus, both physical connections share the same address at the MAC (media access control) layer, and the switch from the hot link to the standby is accomplished transparent to higher-layer applications or bridge/routers.

Dual homing is often confused with seemingly similar capabilities that can be implemented on Token Ring or Ethernet. It is possible to connect a Token Ring or Ethernet bridge/router to the LAN using multiple interfaces, which establish a redundant link. But in this case, each connection has its own MAC address, so routing software must be used to activate the standby link in the event of a failure. If the routing protocol can make the switch quickly enough — a process known as reconvergence — sessions may not be lost, but there's considerable industry-wide controversy over whether even the newest are fast enough.

FDDI really shines when it's used to guarantee high-speed access to networked superservers, which must (by definition) service large numbers of clients. Even though individual users aren't going to need much in the way of throughput, multiple users will quickly eat up bandwidth. On Ethernets or Token Rings, the accepted way of increasing throughput is by installing additional network interface cards in the server.

This approach is not without problems, however. High-performance network adaptors aren't cheap, and additional cards take up server slots that could be used for other resources. And once more adaptors are added, network managers have to start worrying about load balancing, something that most network operating systems are notoriously poor at. Worse, once additional adaptors are added, separate LAN segments must be created. After all, if one adaptor is over-utilised, so is the LAN that's tied into it. The added adaptors can only be utilised fully if new segments are created (by running cable), and that also means deploying more bridge/routers.

FDDI offers a far cleaner solution. A single FDDI card theoretically raises the I/O capacity of an interface to 100Mbps. Thus, users on a number of Ethernet or Token Ring LANs can reach the server simultaneously. In addition, dual homing is available for many of the FDDI cards now on the market. So, FDDI not only dramatically boosts capacity but also raises network reliability to new heights.

Is 100Mbps Really 100Mbps?

FDDI's various fault-tolerant features ensure that network managers building large backbones won't have to worry about reliability. But the same network managers may be troubled by a more basic (and more important) question: how much of FDDI's nominal 100Mbps bandwidth can actually be used?

All too frequently, potential bandwidth proves impossible to attain because of real-world problems. This has long been the case with Ethernet LANs, where collisions limit throughput to only a percentage of the 'available' 10Mbps. The same holds true for Token Ring; when small frames are used, today's software drivers cannot achieve the technology's 16Mbps maximum.

Figure A: Basic FDDI

With its 100Mbps bandwidth, FDDI can readily serve as a backbone for multiple LANs and servers. And since this token-passing technology is implemented with dual fibre optic rings, it's highly fault tolerant.

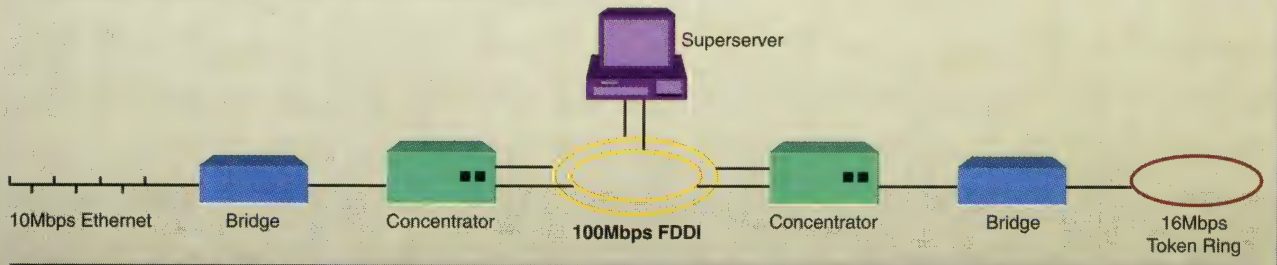
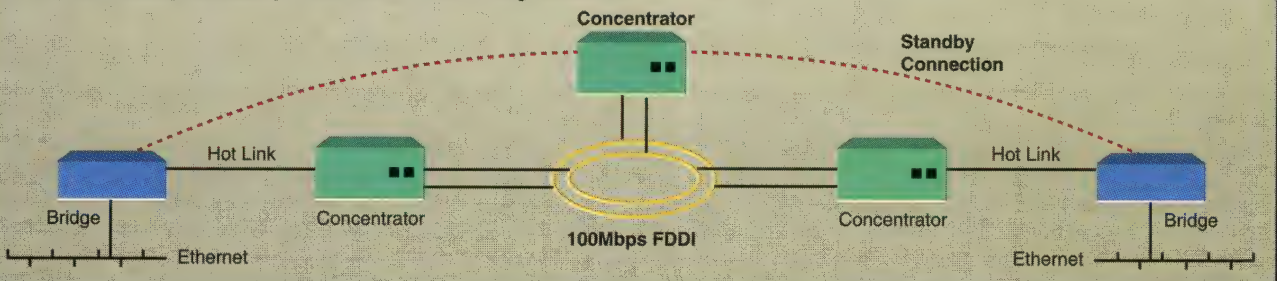


Figure B: Fault-Tolerant FDDI

With dual homing, an FDDI network adaptor slotted into a bridge, router, or server can be simultaneously linked to two FDDI concentrators. Thus, there's always a standby connection if the hot link goes down.



To determine how much bandwidth FDDI really makes available, Interlab, the private testing firm that operates the Data Comm Test Lab, ran a high-speed LU 6.2 application between stations on two different Token Ring LANs bridged across FDDI. Throughput between the LU 6.2 stations was first measured without any competing traffic on the backbone. Frame generators were then used to simulate other traffic on the network — using 4Kbyte frames loads ranging from 10 to 87Mbps — and the LU 6.2 throughput was measured again.

If the FDDI backbone were passing any less than 100Mbps (our initial expectation) the throughput for the LU 6.2 application would naturally trail off — at some point, drastically. After all, any application is sensitive to frame loss.

Degradation was surprisingly low, even insignificant, which indicated that FDDI was able to handle all the traffic being sent. With no competing frames on the backbone, the LU 6.2 application clocked in at 10.13Mbps. When the backbone was loaded with 10, 30, and even 60Mbps throughput fell only slightly. And when the FDDI backbone was loaded with 87Mbps of competing traffic (the most the generator could get onto it), application throughput dropped only slightly to 9.79Mbps.

The total traffic on the LAN amounted to over 96Mbps. Certainly, the results of this show that FDDI's useful capacity verges on 100%. FDDI's token-passing technology obviously works as intended. Although the Lab conducted these tests using Token Ring feeder LANs, the results would also hold if Ethernet had been used.

Duelling Standards

Interoperability is a critical concern for anyone considering FDDI as a backbone technology — especially since there is no standard yet for Token Ring source route bridging over FDDI. Ethernet bridges are not a problem, since the FDDI spec addresses transparent/translation bridging between Ethernet and FDDI. Thus, all vendors have implemented it the same way.

But, without a source routing standard, FDDI bridge vendors have pretty much gone their own ways. Some are using true source routing, as defined by the 802.5 Token Ring spec. The problem with this approach is that source routing uses framing and control bits that FDDI declares as 'unused,' which can lead to conflicts under certain conditions. But true source routing is the highest-performance scheme and the only way to guarantee interoperability.

Some bridges encapsulate the entire Token Ring packet inside FDDI frames (a second bridge strips off the encapsulation on the other side of the ring). The trouble with this approach is that it adds significant overhead and makes it impossible for the encapsulated frames to be delivered directly to stations on the FDDI ring. On the other hand, it's generally the least expensive approach.

Some bridges employ source route conversion. With this approach, the source routing information on the Token Ring is terminated at the bridge (which appears to the sending station as the destination) and converted into either routed or transparent bridged traffic on FDDI. Unfortunately, this routing scheme can't handle NetBIOS and SNA (which must be bridged). What's more, translation bridges exhibit high latency and poor performance.

But network managers needn't despair: A new FDDI standard, known as FDDI MAC-2, is likely to be adopted soon by ANSI. It will specify true 802.5 Token Ring source routing on FDDI. Vendors that already have implemented this technique are exhibiting both high-performance and interoperability.

Network managers may run into other FDDI compatibility problems when they get to network adaptors. Although most adaptors will work with any client or server NOS, some combinations of products will prove problematic. One no-go situation occurs when bridging Novell NetWare traffic between Token Ring and FDDI (bridging NetWare traffic from Ethernet to FDDI is not a problem). Simply put, incompatible addresses make it impossible to bridge IPX clients on Token Ring to NetWare servers on FDDI. Routing must be used instead.

Kevin Tolly

Vendor Profiles

The Lab put FDDI bridge and router solutions from five vendors to the test. Below is a snapshot of what each offered.

DIGITAL EQUIPMENT CORPORATION

DEC supplied one of the two devices in this test capable of routing traffic between an FDDI network and 10 Ethernet segments (Wellfleet's BCN was the other one). Fully loaded, the DECnis 600 supports 14 Ethernets, three FDDI networks, or 56 WAN links (the maximum FDDI-Ethernet configuration is one dual-attached FDDI interface and 10 Ethernet interfaces). Notably, DEC does not manufacture a Token Ring interface; it does resell Token Ring routers from Proteon.

In performance testing, the DECnis 600 turned in respectable results in IP routing and transparent bridging. IPX routing, however, was another story. DEC anticipated lacklustre results before the test by explaining that its current routing software, Version 2.2, is not optimised for IPX routing. The software sends all IPX traffic to the DECnis 600's management module for processing rather than handling it on each interface board — a method that dramatically degrades throughput. DEC says Version 2.3, slated to ship later this year, will process IPX traffic on the interface boards, substantially improving throughput.

MADGE NETWORKS

Madge wins the award for most novel approach to FDDI-Token Ring routing. Its product is not a dedicated box but an amalgam of components from Madge and other vendors. For this test, Madge supplied the Lab with a SystemPro PC from Compaq; NetWare Multiprotocol Router (MPR) software from Novell; and its own FDDI and Token Ring adaptor cards and software drivers. Two of the SystemPro's seven slots held FDDI adaptors, while the other five held Token Ring cards.

The benefits of Madge's cobbled-together router are cost and convenience. The entire package comes in at considerably less than other solutions in this test. What's more, the Madge approach uses common, off-the-shelf software, thus obviating the need to learn a new command language. The drawbacks are features and performance.

Madge's product does not perform bridging, and configuration changes must be handled be editing the AUTOEXEC.NCF file used by NetWare. In the routing arena, Madge's product under-performed the CNX 500 from Proteon (the only other Token Ring router in this test) by a considerable margin, particularly in handling IP traffic.

All the interface cards share a single CPU, a 50MHz Intel 486, and the same 8Mbytes of RAM for processing, forcing the router to cache routing information to disk. In fact, the disk was continually thrashing when the router handled small packets. Madge says adding more RAM would improve performance. The vendor says it also is fine-tuning its drivers for Novell's MPR software.

PROTEON

Like devices from 3Com and Wellfleet, Proteon's CNX 500 supports Ethernet, FDDI, and Token Ring attachments. It uses an AMD 29000 RISC chip to process all LAN traffic. The Lab tested the three-slot CNX 500, which supports one FDDI and four Token Ring segments. Proteon also has a five-slot model, the CNX 600, that allows up to eight LANs to be connected to an FDDI backbone. Interface cards can be swapped between the two products.

Proteon's bridge/router was simple to configure. The vendor's network management software uses a command line interface that offers extensive help for each command. Global changes to all ports are possible, a plus when changing routing or bridging methods over multiple LANs.

The CNX 500 posted very respectable routing numbers — passing both large-packet IP and IPX traffic onto LANs at rates above 12Mbps. But the CNX 500 was unable to bridge 4,096-byte frames. In fact, the largest frame size it would support was just 1,460 bytes — and even then, the unit would not operate when offered 100% of FDDI capacity. The CNX 500's inability to handle large frames and bridge heavy traffic could limit its suitability for high-bandwidth applications. Proteon says it sells extra memory for its Token Ring adaptors that will resolve this problem, but the Lab did not receive the memory by press time.

3COM

3Com was the only vendor in the test to supply separate boxes for bridging and routing. Its LinkBuilder 3GH bridging hub supports up to 10 Ethernet interfaces, each with its own AMD 29000 RISC processor. The LinkBuilder supports Ethernet switching as well as transparent spanning tree bridging. The Lab didn't evaluate the switching feature.

The LinkBuilder was developed by Synernetics. 3Com signed an OEM agreement with Synernetics about two years ago. Today, 3Com makes its own LinkBuilder chassis and management modules, but continues to OEM Synernetics Ethernet modules. Because the LinkBuilder is a hub, it required cross-wired cables (cables with different pin assignments at either end) to be connected to the Bytex hub in the test bed. Other than that, however, both the LinkBuilder and the NetBuilder II router were remarkably easy to configure. Configuration procedures are arranged hierarchically; network managers select a function from a menu, thus bringing up a menu of additional options.

The NetBuilder II router is available in four and eight-slot versions. Like routers from Proteon and Wellfleet, it accommodates Ethernet, FDDI, and Token Ring modules.

WELLFLEET COMMUNICATIONS

The Backbone Concentrator Node (BCN) had the largest capacity of any bridge or router in this test. All told, the BCN supports up to 52 LAN or WAN interfaces, including connections for up to 13 FDDI networks. As many as 48 LAN segments could theoretically be connected to a single FDDI network, although users would undoubtedly run out of bandwidth long before then. Wellfleet also sells a six-slot Backbone Link Node (BLN).

Other high-end features on the BCN include a scalar multiprocessor architecture, hot-swappable interface cards, and optional quadruple power supplies for fault tolerance. Interface cards connect to dedicated routing engine cards via a midplane. Each routing engine card has its own MC68040 processor from Motorola.

One area where the BCN could use improvement is its management interface. Wellfleet's Site Manager software offered the only graphical interface in this test, but it certainly wasn't the most intuitive. For example, Site Manager's map of the BCN's slots and ports is horizontally aligned, while slots in the BCN are vertically aligned. Port control was another net management bugaboo. Despite the large number of ports supported by the BCN, Site Manager does not have a global enable/disable feature — a shortcoming that could add a lot of time when configuration changes are needed.

From page 70

ed Wellfleet by about 100Kbps, and DEC by about 2Mbps.

In Token Ring IP routing, Proteon topped out at 12.512Mbps when handling 4,096-byte packets (see Figure 5). And in routing 4,096-byte IPX packets, the CNX 500 clocked the highest rate in the entire test — 12.768Mbps (see Figure 6).

As mentioned, not all products were able to handle all offered traffic loads. Token Ring bridging was a particular sore spot. Proteon's CNX 500 could not pass 4,096-byte frames. Even at the largest frame size the CNX 500 did support — 1,460-byte byte frames — the Proteon product was not able to bridge 100% of FDDI's offered load. When the Lab throttled back FDDI traffic by 50%, the CNX 500 bridged 1,460-byte frames at 12.240Mbps (see Figure 7). That's more than 75% of the theoretical limit of a 16Mbps Token Ring.

The Proteon box had a lot of trouble with 64-byte frames, posting a recorded throughput of 80Kbps at full offered load and only 120Kbps at 50% offered load. Still, this low throughput may not be too much to worry about, since such small frames would be used for acknowledgments. In any case, Proteon says it has memory modules for its Token Ring interfaces that will remedy its bridging problems.

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DRIVING FORCE

Bergsoe ③ International

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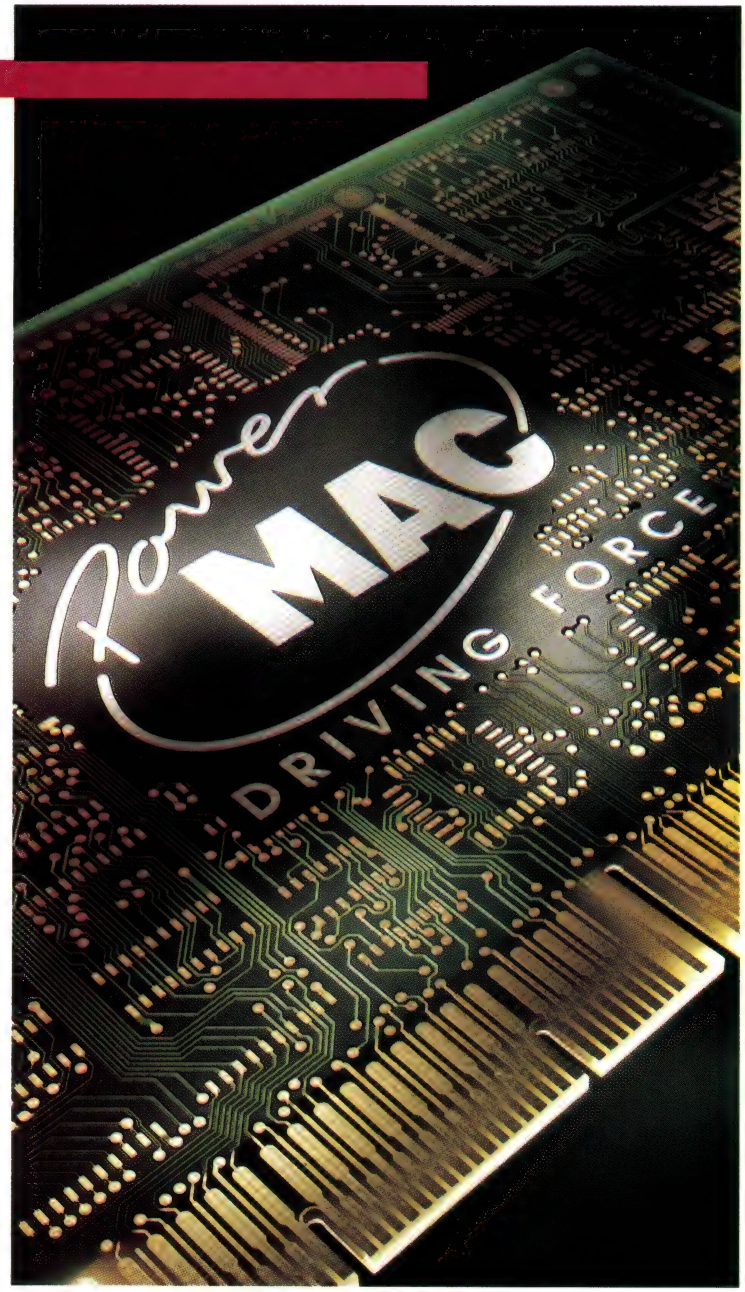

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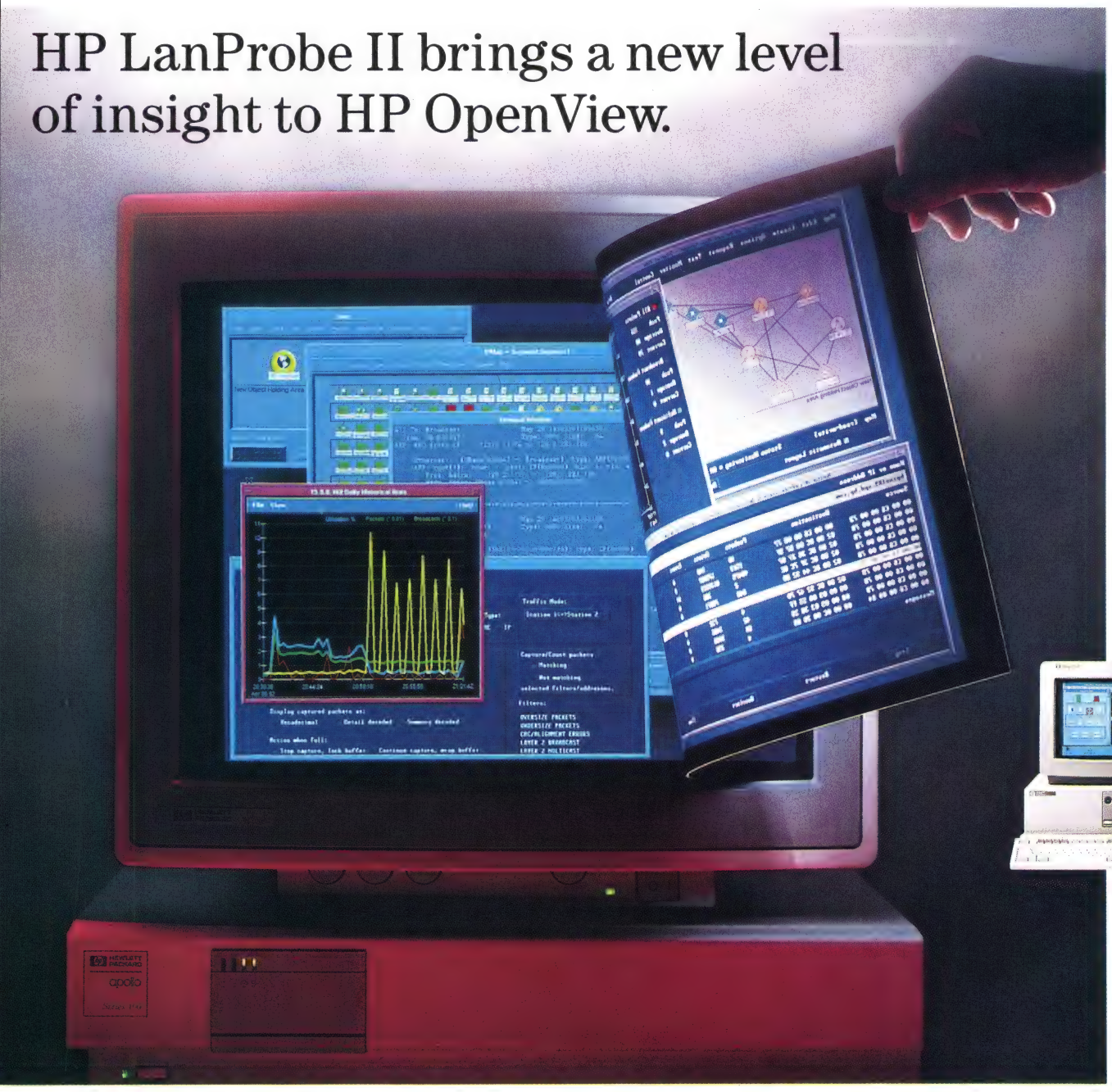

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A Better Way.

HEWLETT PACKARD

ISDN CPE — Uncovering the Second Generation

After a slow start, products and applications designed to exploit the capabilities of the Integrated Services Digital Network are finally starting to appear in numbers.

The latest crop of ISDN customer premises equipment (CPE) to reach the Australian market is a lot more innovative than that which appeared shortly after the introduction of the Integrated Services Digital Network. That first wave of products predominantly provided basic voice and data connection to ISDN; now, with the second wave, the main thrust is greater integration of ISDN services into user applications. For network managers, the result is an increasingly wide range of sophisticated digital communication options; options that are becoming available now rather than sometime along an over-optimistic ATM and Broadband ISDN introduction timetable.

What's driving this second product wave? ISDN was introduced to Australia just on four years ago. During this time users have been drawn to the technology mainly by attractive tariffing by Telecom Australia. But significant changes in the tariffs for long distance calls have eroded the cost benefit of using ISDN for voice-only applications, and the use of ISDN for purely uncompressed 64Kbps voice is no longer significantly cheaper than using PSTN services. Suppliers must now provide more added value to their products by being more applications oriented.

This particularly applies to ISDN products where the initial advantages conferred by digital technology are being eroded by advances in analogue transmission techniques. For example, ISDN terminal adaptors with only basic features for data use are no longer competitive with new analogue modems operating at speeds of 14,400bps and higher that can be purchased at half the price. As a result, the newer terminal adaptors on the market now offer features such as leased line backup, 128Kbps operation by aggregating two B Channels, and subrate multiplexing which allow two or more data ports to share a B Channel.

Also driving the development of ISDN CPE is Telecom Australia, which has added a significant service to ISDN in the past year — B and D Channel access to Austpac, its X.25 network. This now allows ISDN users to connect to existing data applications which have Austpac connections.

Applications, Old and New

Perhaps the biggest revolution is in the area of ISDN LAN bridging products. There are now several suppliers of such equipment and joint ventures such as that between Jtec and Retix bear testimony to the importance of the LAN market. The ISIS Access Server and Workstation from Network Designers provides a good illustration of the features now being offered.

This product provides a cost effective solution to bridging LANs across a wide area network and not only allows LAN bridging but can also provide LAN access to a remotely located workstation. Another nice feature is the Tollsaver function which disconnects the ISDN channel after a predetermined time when no I/O activity is occurring. The software at each end maintains the logical LAN

Continued on page 80

MULTI-PURPOSE PRODUCTS

❑ Yes
■ No

	Product	DATACRAFT AP 4600 BRIDGE, ROUTER, MULTIPLEXER	DATACRAFT AP 4100 BRIDGE, ROUTER, MULTIPLEXER	DATACRAFT DS 2000 MULTIPLEXER, TERMINAL ADAPTOR, B-CHANNEL AGGREGATOR	DATACRAFT 3500 MAINSTREET TERMINAL ADAPTOR, B-CHANNEL AGGREGATOR
BASIC RATE AND PRIMARY RATE ACCESS	Switch Data	❑	❑	❑	❑
	Switch Voice	■	❑	❑	❑
	Direct In-dial	❑	❑	❑	❑
	Time Link	❑	❑	❑	❑
	Semi-Permanent Circuits	❑	❑	❑	❑
	Fax Group 1-3/Group 4	■	❑	Group 4 only	Group 4 only
	Pass Extension/ Port Calling Party Number to Network	❑	❑	❑	❑
	CLIP and CLIR	❑	❑	❑	■
	Sub-Address Transfer	❑	❑	❑	■
	Advice Of Charge	■	■	■	■
	Malicious Call Trace	■	■	■	■
	B Channel Packet Data	❑	❑	❑	❑
	D Channel Packet Data	Q2 1994	Q2 1994	Q2 1994	■
	V.24/X.21*bis*	❑	❑	❑	❑
	X.21	❑	❑	❑	❑
	V.35	❑	❑	❑	❑
	Analogue Telephone	■	■	❑	❑
	LAN Interface	❑	❑	■	■
	G.703	■	❑	❑	❑
	Data Rates Supported	1.2 - 128Kbps	1.2Kbps - 2Mbps	1.2Kbps - 4Mbps	1.2Kbps - 2Mbps
	Rate Adaption Standards	V.110/V.120/X.30/X.31	V.110/V.120/X.30/X.31	V.110	V.110
CALL CONTROL					
	Hayes AT Commands	■	■	■	■
	X.21 Call Control	❑	❑	❑	❑
	X.28 Commands (For X.25 PAD)	❑	❑	■	■
	V.25*bis*	❑	❑	❑	❑
MAINTENANCE					
	Self Diagnostics	❑	❑	❑	❑
	Local and Remote Loopbacks	❑	❑	❑	❑
	Statistic Gathering	❑	❑	❑	❑
	Alarm Reporting	❑	❑	❑	❑
CONFIGURATION					
	Application Program Interface	❑	❑	■	■
	External PC	❑	❑	❑	❑
N X 64K PORTS					
	X.21/RS449	❑	❑	❑	❑
	X.21 Call Control	❑	❑	❑	❑
	Dynamic Configurations	❑	❑	❑	❑
	Maximum Rate (Kbps)	128Kbps	2Mbps	4Mbps	1.5Mbps
VOICE LINE CARDS					
	2-wire ring/loop	■	■	■	■
	4-wire E&M	■	■	❑	■
	Voice Compression Rates (Kbps)	■	■	16, 24, 32Kbps	■

MULTI-PURPOSE PRODUCTS					
DESIGN 2000	JTEC	JTEC	JTEC	SCITEC	SCITEC
BRA 2000 PC TA PC CARD, TERMINAL ADAPTOR	J1800/1700 MULTIPLEXER, TERMINAL ADAPTOR, B-CHANNEL AGGREGATOR	J1500 MULTIPLEXER, TERMINAL ADAPTOR, B-CHANNEL AGGREGATOR	TERMINAL ADAPTOR, B-CHANNEL AGGREGATOR	MAXIMA 100 TERMINAL ADAPTOR, B-CHANNEL AGGREGATOR	MULTIBAND INVERSE MULTIPLEXER, TERMINAL ADAPTOR, B-CHANNEL AGGREGATOR
❑	❑	❑	❑	❑	❑
❑	❑	❑	■	■	■
❑	❑	❑	❑	❑	❑
❑	❑	❑	❑	■	■
❑	❑	❑	❑	❑	■
❑	❑	❑	❑	■	■
❑	❑	❑	❑	❑	■
❑	❑	❑	❑	❑	■
❑	❑	❑	❑	■	■
❑	❑	❑	❑	■	■
❑	❑	❑	❑	■	■
❑	❑	❑	❑	■	■
❑	Supported for NMS sessions	Supported for NMS sessions	Supported for NMS sessions	■	■
■	❑	❑	❑	■	■
■	❑	❑	❑	❑	❑
■	❑	❑	❑	❑	❑
❑	❑	❑	❑	■	■
❑	1994	1994	■	■	■
■	❑	■	■	❑	■
128Kbps	Up to 504Kbps for X.21/V.35; 2Mbps for G.703	Up to 504Kbps for X.21/V.35	Up to 126Kbps	30 X 64Kbps	64 - 1028Kbps
X.30/X.31	V.110/X.30	V.110/X.30	V.110/X.30	■	■
❑	❑	❑	❑	■	■
❑	❑	❑	❑	■	❑
❑	■	■	■	■	■
■	1994	1994	1994	■	❑
❑	❑	❑	❑	❑	❑
❑	❑	❑	❑	❑	❑
❑	❑	❑	❑	❑	❑
❑	❑	❑	❑	❑	❑
❑	■	■	■	■	■
❑	❑	❑	❑	❑	❑
■	❑	❑	❑	❑	❑
■	❑	❑	❑	■	❑
❑	❑	❑	❑	❑	❑
128Kbps	504Kbps	504Kbps	126Kbps	30 x 63Kbps	16 x 64Kbps
❑	❑	❑	■	■	■
❑	❑	❑	■	■	■
■	16/24/32Kbps	16/24/32Kbps	■	■	■

LAN PRODUCTS

❑ Yes
■ No

	Product	NETWORK DESIGNERS ISIS ACCESS SERVER	NETWORK DESIGNERS ISIS WORKSTATION	GANDALF LANLINE 5240 LAN BRIDGE
BASIC RATE AND PRIMARY RATE ACCESS	Switch Data	❑	❑	❑
	Switch Voice	■	❑	■
	Direct In-dial	❑	❑	■
	Time Link	❑	❑	❑
	Semi-Permanent Circuits	❑	❑	❑
	Fax Group 1-3/Group 4	■	■	■
	Pass Extension/ Port Calling Party Number to Network	❑	❑	❑
	CLI	❑	❑	❑
	Sub-Address Transfer	❑	❑	❑
	Advice Of Charge	❑	❑	■
	Malicious Call Trace	■	❑	■
	B Channel Packet Data	❑	❑	■
	D Channel Packet Data	❑	❑	■
	Data Rates Supported	64 - 640Kbps	64 - 128Kbps	64 - 128Kbps
	Rate Adaption Standards	V.110/V.120	V.110/V.120	V.110/V.120/X.30/X.31
	Hayes AT Commands	For packet data	For packet data	■
	X.28 Commands (For X.25 PAD)	❑	❑	■
	Application Program Interface	❑	❑	■
	External PC	❑	❑	❑
LAN INTERFACES				
	IEEE 802.3 (Ethernet)	❑	❑	❑
	Support for layer 2 M.A.C. local bridges and layer 3 routers	❑	❑	❑
	IEEE 802.5 (Token Ring)	Via external adaptor	Via external adaptor	■
VOICE LINE CARDS				
	2-wire ring/loop	❑	❑	■
	4-wire E&M	■	❑	■
	Voice Compression Rates (Kbps)	9.6Kbps	9.6Kbps	■
APPLICATIONS SOFTWARE				
	PC-to-PC File Transfer	❑	❑	■
	Com Port Emulation	❑	❑	■
	NetBIOS Interface	❑	❑	■
	Novell LAN Bridge	❑	❑	■

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connections and if an I/O request occurs, will re-establish the ISDN connection in less than 100 milliseconds. There is also a feature known as Tenacity that will automatically re-establish the ISDN connection if failure occurs during I/O access. It is also very easy to configure the system to aggregate two B Channels, giving 128Kbps bandwidth. This is far more cost effective and quicker for file transfers than the use of modems and the PSTN.

One industry group that could really take advantage of such technology is the retail sector. I came across one retailer last year that was centralising all sales and ordering functions by using PCs at the point of sale. At night time the PCs at all of the stores in Australia and New Zealand were to be polled by the head office computer and the sales files transferred and stock codes updated. It would be possible to achieve each of these transfers for just the cost of the ISDN flagfall, which is cheaper than a PSTN call.

Most people are aware that videoconferencing is a very popular ISDN application, but there is another similar application that many people may not be aware of — broadcast quality audio circuits. The ABC in Australia has already been using switched ISDN B Channels to provide audio links for overseas sports broadcasts such as the Wimbledon Tennis Championships. For this application a transparent switched 64Kbps circuit is used with 7 kHz codecs conforming to G.722 at each end. It is possible to provide higher quality by the use of multiple B Channels. The main attraction of ISDN to the broadcast industry is the ability to provide audio quality circuits on demand at cheaper rates than specially provided analogue circuits. The use of ISDN for sports and other telecasts is sure to increase in the future.

There have also been changes made to Group 4 fax machines. When ISDN was

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TERMINAL ADAPTORS

❑ Yes
■ No

	Product	ASCOM-TIMEPLEX IDB 64/2i & C ITAM	DATACRAFT MICROTAP 1600	DESIGN 2000 BRA 2000S	GANDALF TA-1	GEOCOM MDTA
BASIC RATE AND PRIMARY RATE ACCESS	Switch Data	❑	❑	❑	❑	❑
	Switch Voice	■	■	❑	■	■
	Direct In-dial	■	■	❑	■	❑
	Time Link	■	❑	❑	❑	■
	Semi-Permanent Circuits	❑	❑	❑	❑	■
	Fax Group 1-3/Group 4	■	Group 4 only	Group 3	■	■
	Pass Extension/ Port Calling Party Number to Network	■	■	❑	❑	❑
	CLI	❑	❑	❑	■	❑
	Sub-Address Transfer	❑	❑	❑	■	■
	Advice Of Charge	■	■	❑	■	■
	Malicious Call Trace	■	■	❑	■	■
	B Channel Packet Data	■	❑	❑	❑	■
	D Channel Packet Data	■	■	❑	■	❑
	V.24/X.21*bis*	❑	❑	❑	❑	❑
	X.21	❑	❑	❑	❑	■
	V.35	❑	❑	❑	❑	■
	Analogue Telephone	■	■	❑	■	■
	Data Rates Supported	300 - 38.4Kbps Async 300 - 64Kbps Sync	1.2 - 64Kbps	128Kbps	1.1 - 64Kbps	9Kbps
	Rate Adaption Standards	V.110/X.30	V.110/X.30	V.110	V.110/X.30	■
	Hayes AT Commands	Yes (C ITAM)	❑	❑	❑	■
	X.21 Call Control	❑	❑	❑	■	■
	X.28 Commands (For X.25 PAD)	■	■	❑	■	❑
	V.25*bis*	Yes (C ITAM)	❑	■	■	■

1. Also I.460, I.461, I.463, ECMA102 2. Including 56Kbps 3. Excluding 56Kbps

ROUTERS

❑ Yes
■ No

	Product	CISCO CISCO 3000	DATACRAFT AP 4700	INTERLINK ACE	RETIX† RX 7000
BASIC RATE AND PRIMARY RATE ACCESS	Switch Data	❑	❑	❑	❑
	Switch Voice	■	■	❑	❑
	Direct In-dial	❑	❑	❑	❑
	Time Link	■	❑	❑	❑
	Semi-Permanent Circuits	❑	❑	❑	❑
	Pass Extension/ Port Calling Party Number to Network	■	❑	■	❑
	CLIP and CLIR	■	❑	■	❑
	Sub-Address Transfer	❑	❑	■	❑
	Advice Of Charge	■	■	■	❑
	Malicious Call Trace	■	■	■	■
	B Channel Packet Data	❑	❑	❑	❑
	D Channel Packet Data	■	Q2 1994	❑	■
	IEEE 802.3 (Ethernet)	❑	❑	❑	❑
	Support for layer 2 M.A.C. local bridges and layer 3 routers	❑	❑	❑	❑
	IEEE 802.5 (Token Ring)	❑	❑	■	❑

† With Jtec-supplied front end. An RX 7000 release with embedded Jtec ISDN technology will be available next year

TERMINAL ADAPTORS

IBM	RACAL	RACAL	TELECOM/ PHILIPS	TELECOM/ PHILIPS	TELECOM/ PHILIPS	TELECOM/ PHILIPS
7820	DAP 4500	DAP 4100	TA-X.21/V.24	TA-V.35	TA-V.24	TA-MULTI 2D2A
❑	❑	❑	❑	❑	❑	❑
■	■	■	■	■	■	❑
❑	■	■	❑	❑	❑	❑
■	❑	❑	❑	❑	❑	❑
❑	❑	❑	❑	❑	❑	❑
■	■	■	■	■	■	■
■	■	■	■	■	■	■
❑	❑	❑	❑	❑	❑	❑
❑	❑	❑	❑	❑	❑	■
■	■	■	■	■	❑	■
■	■	■	■	■	■	■
■	❑	❑	■	■	■	❑
■	❑	❑	■	■	■	❑
❑	❑	❑	❑	■	❑	❑
❑	❑	❑	❑	■	■	❑
❑	❑	❑	■	❑	■	❑
■	■	■	■	■	■	❑
2 x 64Kbps	2.4 - 64Kbps	2.4 - 64Kbps	0.3 - 64Kbps[3]	2.4 - 64Kbps[3]	Up to 64Kbps	1.2 - 64Kbps[2]
V.110/X.30[1]	❑	V.110/X.30	X.30/RIII	X.30	V.110/X.30	V.110/X.30/X.31
■	❑	❑	❑	■	❑	❑
❑	❑	❑	❑	■	■	❑
■	■	■	■	■	■	■
■	■	■	❑	■	❑	❑

introduced to Australia back in 1989, Group 4 fax machines only had a V.35 or X.21 access port. This necessitated the use of an additional terminal adaptor to connect back to the ISDN network. Now all Group 4 fax machines on the market have direct ISDN connection capability and there are now several new ISDN PC cards which support Group 4 fax.

Another ISDN application that continues to grow in popularity is the multiplexing of 32Kbps and lower bit rate voice into a single 64Kbps B Channel. Sometimes this is coupled with bandwidth management to produce a cost effective solution for integrating the transmission of voice and data traffic.

The PABX suppliers are still slow to produce products that provide such functionality within their own hardware. It is usually necessary to purchase an external ISDN multiplexer or ISDN bandwidth manager and use four-wire analogue E&M circuits between the systems to convey the voice circuits. PABX signalling can be passed to the remote PABX by using a data port connection on the ISDN multiplexer. Telecom's tariffing of semi-permanent ISDN circuits makes this application a very cost effective method of providing voice and data between remote business offices.

Standardising Services

The development of ISDN CPE will also be heavily influenced by the evolution of international standards for ISDN supplementary services. At the time that Telecom introduced ISDN to Australia these standards (which govern features such as calling line identification presentation/restriction and sub-addressing) had not been ratified by the CCITT.

The CCITT recommendation for generic control of supplementary services is known as Q.932. It actually defines three different methods of controlling supplementary services: keypad, feature key management and functional. The first two methods are known as 'stimulus' since they do not require the terminal equipment to have any knowledge of the invoked supplementary service. The functional method requires specific messages and protocols to be defined for every supplementary service offered.

The Europeans have gone in the direction of functional control of supplementary services while the US has adopted keypad and feature key management. The European approach has bogged down somewhat since specific protocol interactions must be defined for all new supplementary services. At present only a small set of supplementary service procedures have been fully defined.

The advantage of using a functional protocol is that more sophisticated services such as conference call and other 3-party services can be provided. However, the downside is that as new services are defined, the terminal equipment must be upgraded to make use of them. It is worth men- tioning that this approach is the same one used within the GSM digital mobile network. If additional services are added to GSM then all terminals must be upgraded to take advantage of these services.

The stimulus procedures will allow the rapid introduction of sophisticated new supplementary services to the network. An easy way of understanding this approach is to

Continued on page 86

PC CARDS

❑ Yes
■ No

	Product	JTEC 2050	TELECOM/ PHILIPS PCONNECT-DV	PHILIPS PCONNECT-DD	NETCOMM† PLANET
BASIC RATE AND PRIMARY RATE ACCESS	Switch Data	❑	❑	❑	❑
	Switch Voice	❑	❑	■	❑
	Direct In-dial	❑	❑	❑	❑
	Semi-Permanent Circuits	❑	■	❑	■
	Fax Group 1-3/Group 4	❑	■	■	■
	Pass Extension/ Port Calling Party Number to Network	❑	■	■	❑
	CLI	❑	❑	❑	❑
	Sub-Address Transfer	■	❑	❑	❑
	Advice Of Charge	❑	■	■	■
	Malicious Call Trace	■	■	■	■
	B Channel Packet Data	■	❑	■	❑
	D Channel Packet Data	■	❑	■	■
	V.24/X.21*bis*	❑	■	■	❑
	Analogue Telephone	❑	❑	■	❑
	LAN Interface	Through NetBIOS server support	❑	❑	■
	Data Rates Supported	64Kbps	64Kbps	128Kbps	9.6 - 57.6Kbps Async 64Kbps Sync
	Rate Adaption Standards	V.110	V.110	V.110	■
	Hayes AT Commands	❑	❑	■	❑
	V.25*bis*	■	❑	■	■
	Application Program Interface	❑	❑	❑	❑
	PC-to-PC File Transfer	❑	❑	❑	❑
	Com Port Emulation	❑	❑	■	❑
	NetBIOS Interface	❑	❑	■	❑
	Novell LAN Bridge	■	❑	❑	❑

† Internal board for Apple Macintosh

PABXS

❑ Yes
■ No

	Product	NEC NEAX2400 IMS†	NEC NEAX2400 SDS	ERICSSON MD110	NORTEL MERIDIAN 1	GPT ISDX
BASIC RATE AND PRIMARY RATE ACCESS	Switch Data	❑	❑	❑	❑	❑
	Switch Voice	❑	❑	❑	❑	❑
	Direct In-dial	❑	❑	❑	❑	❑
	Time Link	❑	■	■	■	❑
	Semi-Permanent Circuits	❑	❑	❑	■	❑
	Fax Group 1-3/Group 4	❑	❑	❑	❑	❑
	Pass Extension/ Port Calling Party Number to Network	❑	❑	❑	❑	❑
	CLIP and CLIR	❑	❑	❑	❑	❑
	Sub-Address Transfer	❑	❑	■	■	I/C only
	Advice Of Charge	❑	❑	❑	1994	❑
	Malicious Call Trace	Q1 1994	Q1 1994	❑	1994	1994
	B Channel Packet Data	■	■	❑	■	■
	D Channel Packet Data	■	■	■	■	■
	Phone on Data Calls from Directory	❑	❑	■	❑	❑
	Automatic Call Announcer	❑	❑	■	❑	External

† Primary Rate access only

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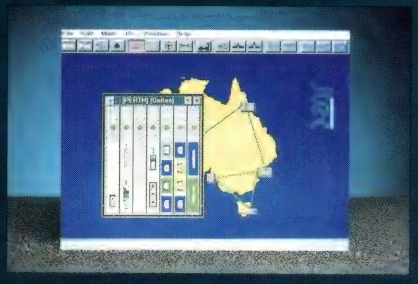

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MISCELLANEOUS PRODUCTS

❑ Yes
■ No

	Product	TELOGY ISDNet CALL CENTRE	TELOGY ISDNet TELECONFERENCING CENTRE	TELOGY ISDNet I.V.R./MESSAGING CENTRE	LABTAM XENGINE X TERMINAL
PRIMARY RATE ACCESS ONLY	Switch Data	❑	❑	❑	❑
	Switch Voice	❑	❑	❑	■
	Direct In-dial	❑	❑	❑	■
	Time Link	■	■	■	❑
	Semi-Permanent Circuits	■	■	■	❑
	Fax Group 1-3/Group 4	YES/Q2 1994	YES/Q2 1994	YES/Q2 1994	■
	Pass Extension/ Port Calling Party Number to Network	❑	❑	❑	■
	CLIP and CLIR	❑	❑	❑	❑
	Sub-Address Transfer	❑	❑	❑	❑
	Advice Of Charge	❑	❑	❑	■
	Malicious Call Trace	❑	❑	❑	■
	B Channel Packet Data	❑	❑	❑	■
	D Channel Packet Data	❑	❑	❑	User-User
	V.24/X.21*bis*	Q2 1994	Q2 1994	Q2 1994	❑
	X.21	Q2 1994	Q2 1994	Q2 1994	■
	V.35	■	■	■	■
	Analogue Telephone	❑	❑	❑	■
	LAN Interface	❑	❑	❑	❑
	G.703	❑	❑	❑	■
	Data Rates Supported	Multiple 64Kbps up to 4Mbps	Multiple 64Kbps up to 4Mbps	Multiple 64Kbps up to 4Mbps	V.24 - Up to 115Kbps Ethernet 10Mbps
	Rate Adaption Standards	V.110/V.120 - Q2 1994	V.110/V.120 - Q2 1994	V.110/V.120 - Q2 1994	V.110
N X 64K PORTS					
	X.21/RS449	Q2 1994	Q2 1994	Q2 1994	■
	X.21 Call Control	■	■	■	■
	Dynamic Configurations	Q2 1994	Q2 1994	Q2 1994	❑
	Maximum Rate (Kbps)	3.84Mbps	3.84Mbps	3.84Mbps	128Kbps
VOICE LINE CARDS					
	2-wire ring/loop	❑	❑	❑	■
	4-wire E&M	■	■	■	■
	Voice Compression Rates (Kbps)	24, 32,64, 128Kbps	24, 32,64, 128Kbps	24, 32,64, 128Kbps	■
APPLICATIONS SOFTWARE					
	Phone on Data Calls From directory	❑	❑	❑	❑
	Automatic Call Announcer	❑	❑	❑	■
	CLI Display	❑	❑	❑	❑
	PC-to-PC File Transfer	❑	❑	❑	■
	Com Port Emulation	Q2 1994	■	Q2 1994	■
	NetBIOS Interface	Q2 1994	■	Q2 1994	■
	Novell LAN Bridge	Q2 1994	■	Q2 1994	■

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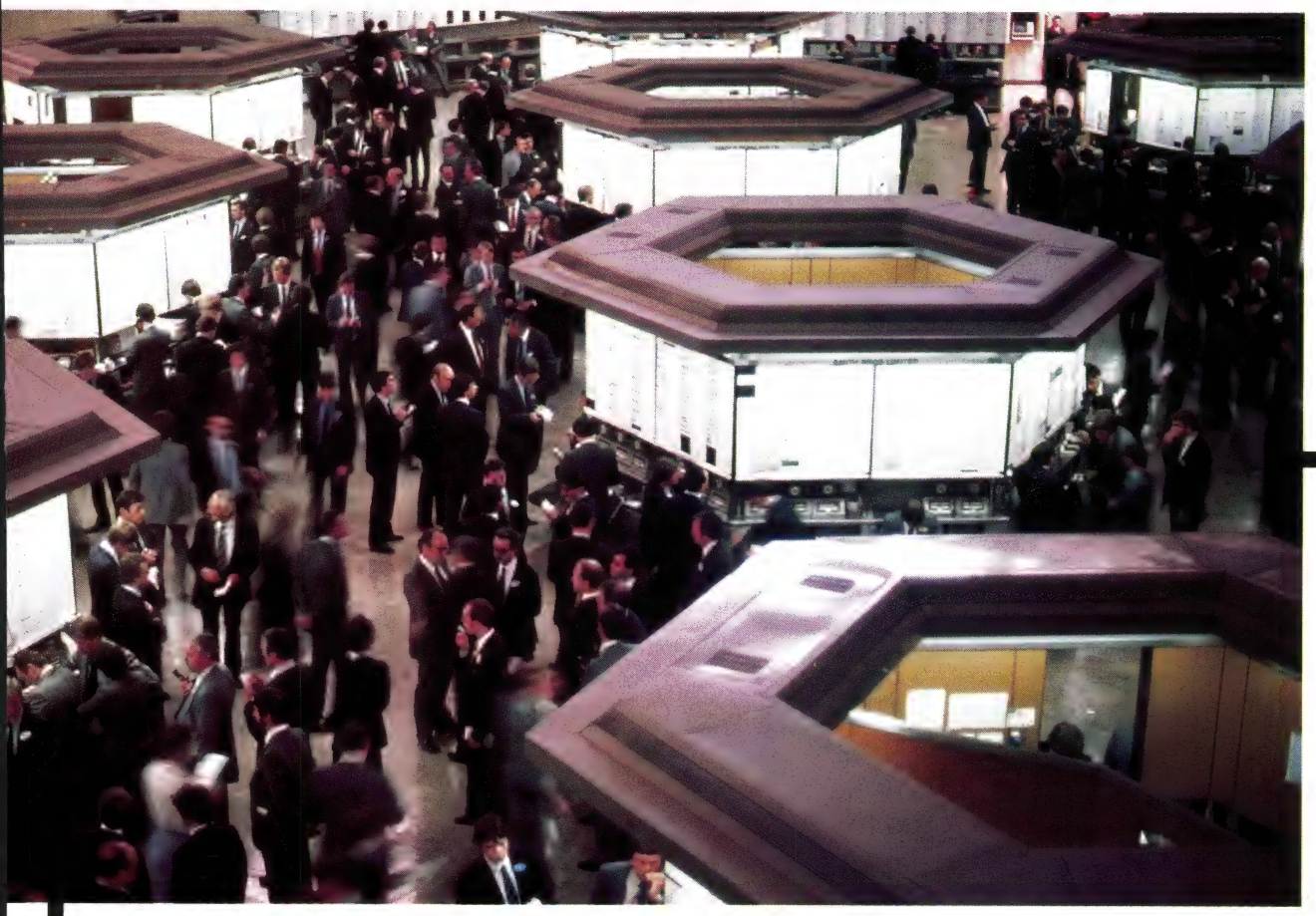
visualise the current feature phone that a large number of PABX systems have. The telephone has a number of buttons that can activate various features such as call transfer, call hold etc. New features can be added by upgrading the software of the PABX without upgrading the telephone handset.

Indications to date are that Telecom favours that all three approaches be optional within the Australian network. Its Spectrum ISDN service already follows these procedures, however the ISDN services currently provided by Microlink do not. The use of specific functional procedures is seen to be advantageous for the offering of more complex multi-party services.

Telecom, Optus and Austel are hop that a common approach will be reached the provision of supplementary servi within Australia. This should mean a wh new range of ISDN supplementary servi can be provided to users of the ISDN n work in the years ahead.

Carriers, switch suppliers and compu suppliers are also working towards a co



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MULTIPLEXERS

❑ Yes
■ No

	Product	RACAL ISX 5010	GANDALF 2300	ERICSSON AUSTRALIA† IDNX	INFOTRON SYSTEMS PRA-2
BASIC RATE AND PRIMARY RATE ACCESS	Switch Data	❑	❑	❑	❑
	Switch Voice	❑	❑	❑	❑
	Direct In-dial	■	❑	■	❑
	Time Link	❑	❑	■	❑
	Semi-Permanent Circuits	❑	❑	❑	❑
	Fax Group 1-3/Group 4	❑	Group 3 only	Group 3 only	Group 3 only
	Pass Extension/ Port Calling Party Number to Network	■	■	❑	❑
	CLIP and CLIR	❑	■	❑	■
	Sub-Address Transfer	❑	■	■	■
	Advice Of Charge	■	■	■	■
	Malicious Call Trace	■	■	■	■
	B Channel Packet Data	❑	■	❑	■
	D Channel Packet Data	❑	■	❑	■
	V.24/X.21*bis*	❑	❑	❑	❑
	X.21	❑	❑	❑	❑
	V.35	❑	❑	❑	❑
	Analogue Telephone	■	❑	■	❑
	LAN Interface	■	❑	❑	❑
	G.703	■	❑	❑	❑
MAINTENANCE					
	Self Diagnostics	■	❑	❑	❑
	Local and Remote Loopbacks	❑	❑	❑	❑
	Statistic Gathering	❑	❑	❑	❑
	Alarm Reporting	❑	❑	❑	❑
CONFIGURATION					
	Application Program Interface	■	■	■	■
	External PC	❑	❑	❑	❑
VOICE LINE CARDS					
	2-wire ring/loop	❑	❑	■	❑
	4-wire E&M	❑	❑	❑	❑
	Voice Compression Rates (Kbps)	4.8 - 32Kbps	8 - 32Kbps	8 - 32Kbps	4.7 - 32Kbps

† Ericsson's IDNX supports Primary Rate access only

mon standard for interfacing the telephone switch with computer systems. This is referred to as TASC, or Telephone Applications interface Switch to Computer. ANSI has already published a standard known as SCAI, or Switch to Computer Application Interface. This is available on the NorTel DMS-100 switches that are used by both Telecom and Optus.

A typical configuration might involve a separate control path (usually via X.25) to allow an external computer to initiate or control delivery of telephone calls. Sophisticated applications such as personal telephone support, customer support environment, emergency call control, integrated message desk and telemarketing will all be possible.

Unfortunately, the push for an international standard for TASC has been gridlocked for the past two years due to two opposing standards. While ANSI has developed SCAI, in Europe the ECMA (European Computer Manufacturers Association) has developed a standard known as Computer Supported Telecommunication Applications (CSTA). The international standard to be developed is equally applicable in the public domain as in the private domain. Telecom Australia has already produced some experimental applications for the SCAI interface through its research facility in Wollongong. The combination of ISDN signalling, SCAI and other Intelligent Network capabilities will provide a very powerful platform for future applications. And even more sophisticated telecommunication systems will be designed when access to ISDN D Channel signalling is available.

Enhanced network services will become even more important once Optus begins offering business customers direct connection to its network. And several announcements made by Telecom in the past few months indicate the importance it places on providing additional services within the telephone network. For instance, it is currently trialling new AXE Plus software at a number of Ericsson AXE exchanges.

Greg Smith is Principal Consultant with Melbourne-based Envision Communications, an independent communications consultancy specialising in ISDN.

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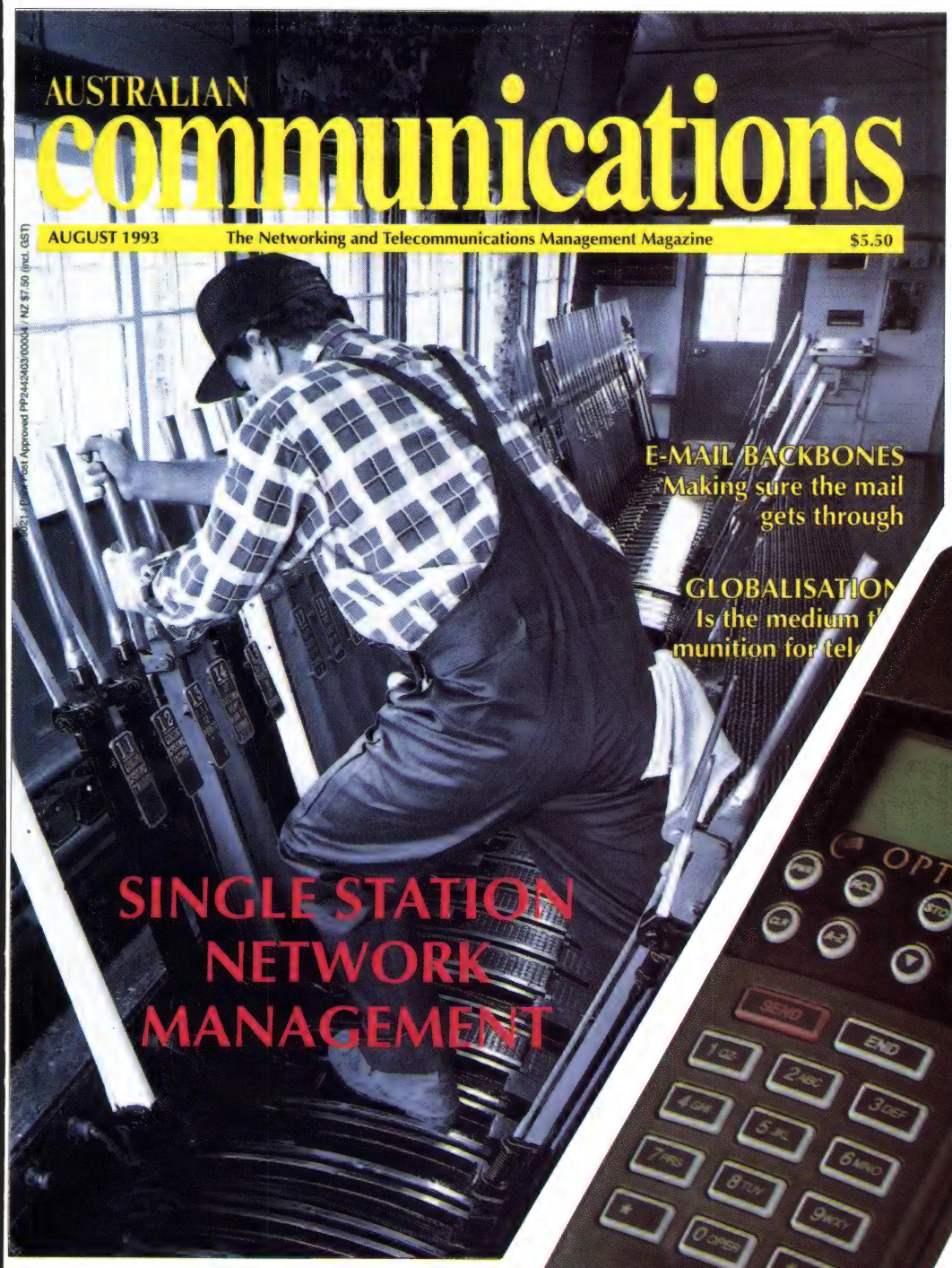

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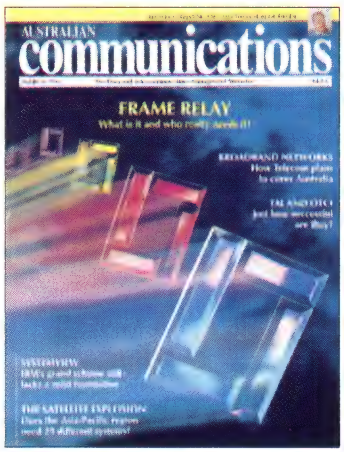

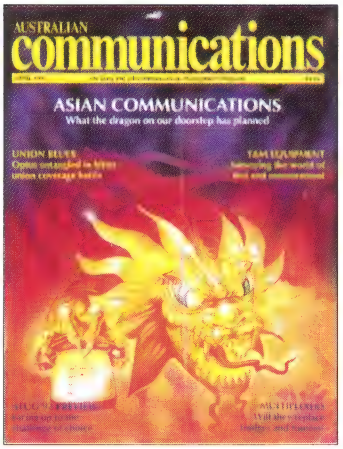

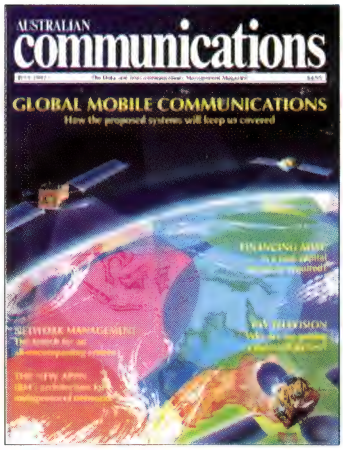

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Managing High-Speed WANs: Just Wait

High-speed wide area networks are on the way, but makers of high-speed switches are just beginning to tackle the job of developing management standards for their products.

For managers of corporate networks, patience isn't a virtue — it's a fundamental job skill. Over the years, network managers have waited for equipment and services that would bring affordable multimegabit speeds to wide area networks. They've also been waiting for networking vendors to get their collective act together and rally around a single standard for managing network resources.

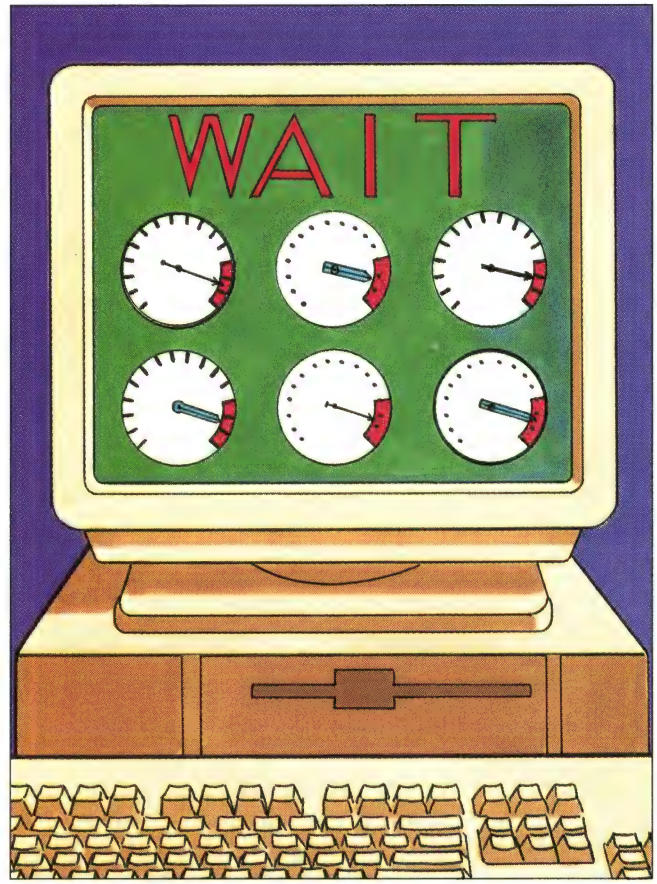
By most accounts, those days of waiting may nearly be over. High-speed technologies and services like ATM switching, frame relay, broadband ISDN, and Fastpac/SMDS are starting to break up WAN bottlenecks in enterprise networks. Meanwhile, networking vendors are tripping over one another in the scramble to make their products conform to SNMP, the protocol standard that is expected to end the era of proprietary network management.

Now that high-speed WANs and network management standards are falling into place, net managers can take a deep breath, roll up their sleeves . . . and wait some more, as vendors and standards groups grope for a way to bring high-speed switches and net management standards comfortably together. Unfortunately, an overnight solution to this problem isn't likely.

At first glance, the problem of managing high-speed switches in corporate internetworks appears to be a non-issue.

SNMP is the clear-cut choice for standardised network management, and most vendors of high-speed switches tout SNMP compliance for their products. But high-speed WANs generate much more management data than LANs and LAN internetworks. This inherent complexity affects every area of management — performance, configuration, fault management, security, and accounting. The sad truth is that almost all of today's SNMP-based network management systems do not have the horsepower to keep pace with these added demands.

What's more, in networks operating at T3/DS-3 45Mbps speeds and above, there's often no time for an SNMP management station to get involved in configuration and fault management of the WAN. If a virtual connection fails in a high-speed packet or cell-based network, the switches themselves must react instantaneously to establish new connections. This requires the use of proprietary protocols built for speed and efficiency. The role of an SNMP management system then becomes one of staying abreast of changes already made by the switches. Makers of high-speed switches are well aware of SNMP's limitations when it comes to managing their products. But user demand for SNMP compliance is so great that most vendors won't risk bypassing SNMP for fear of losing customers.



Most switch vendors are treating SNMP compliance as a stopgap until a better solution comes along. One possibility is SNMP 2, which was recently approved as a proposed standard by the Internet Engineering Task Force (IETF, see 'Coming Soon to a Network Near You,' *Australian Communications*, March 1993 for a description of SNMP 2). Another protocol that may emerge is the ISO-approved common management information protocol (CMIP), which has a strong following among carriers and some switch vendors.

Selected High-Speed Switches and Their Management Systems

VENDOR	PRODUCT	SWITCH TYPE/ (MAXIMUM INPUT RATE)	MANAGEMENT SOFTWARE	SOFTWARE TYPE
BBN Communications (02) 660 8500	Emerald	ATM cell switch/(up to 45Mbps)	Configurator and Collector	Unix-based applications
General Datacomm (02) 956 5099	Apex	Circuit, packet and cell switch/(up to 155Mbps)	Apex Network Management	Unix-based management application
Newbridge Networks Datacraft (03) 735 3333	3645 Mainstreet High Capacity Bandwidth Manager	Circuit and packet switch/(up to 45Mbps)	4602 Mainstreet Intelligent Network Station	Unix-based management system
	36150 Mainstreet	Circuit and packet switch/(up to 155Mbps)	4602 Mainstreet Intelligent Network Station	Unix-based management system
Northern Telecom (02) 428 8777	Magellan Passport	Circuit, packet and cell switch/(1.56Mbps interface in first release; T3 interface by Q4 1994)	Magellan Network Management System	SNMP-compatible Unix applications
Stratacom Digital Equipment Corporation (02) 561 5252	BPX	Circuit and packet switch/(up to 45Mbps)	Strataview Plus	Unix-based management system
	IPX	Circuit and packet switch/(up to 45Mbps)	Strataview Plus	Unix-based management system
SynOptics Communications (03) 853 0799	LattisCell ATM Switch	ATM cell switch/(up to 155Mbps)	LattisCell Connection Management System (CMS) and LattisCell ATM Management Application	Unix-based switch control software (CMS, which runs on a Sun Sparcstation) and management applications integrated with vendor's Optivity system
Telematics Datacraft (03) 735 3333	NCX (Net Cell Exchange) Atom	ATM cell switch/(up to 155Mbps)	Open Management Software	Unix-based management application integrated with HP OpenView

† Switch control includes call setup, automatic rerouting, congestion control, and other real-time functions of high-speed networks

Under one popular scenario, SNMP and CMIP will function as complementary protocols, with SNMP handling the customer premises and CMIP the carrier switch communications. Support for CMIP hasn't progressed much past the talking stage, however, and some observers wonder if the cost of CMIP compliance will be too great for vendors and users to bear.

Switch vendors say they are committed to working with standards bodies and industry groups to extend standard management protocols to their products, but approval of new techniques will take time. This means more waiting for managers who want to bring high-speed access switches under the purview of the same management systems that handle their LANs and internetworks. In the meantime, switch vendors are creating interim management solutions typically based on a mixture of proprietary and standard technologies (see table). These systems show switch vendors' attempts to achieve balance between meeting the special requirements of high-speed networks and maintaining SNMP compliance. Because of this, the products vary in the degree of control they provide over switch functions.

Some vendors, including NET/Adaptive and Stratacom allow switches to handle their own call setup, automatic rerouting, and congestion management, reporting all changes to the net management system after the fact. In contrast, individual switches from Newbridge Networks control their own direct connections, but the vendor's proprietary net management system controls these functions for the entire network of switches. SynOptics Communications offers two workstation-based management packages — one for controlling switch functions like call setup, automatic rerouting, and congestion management, and one integrated with the vendor's Optivity SNMP hub management software.

Switch makers aren't the only networking vendors with an interest in developing management standards. Companies that offer existing net management platforms are working with switch vendors to develop management capabilities for high-speed switches. IBM is working with several WAN equipment vendors, including NET/Adaptive, SynOptics, and T3plus Networking, to integrate their management software with IBM's NetView/6000 platform. Vendors of carrier management systems, such as Applied Computing Devices, Digital Analysis, Netlabs, and Objective Systems Integrators, also are extending their offerings to incorporate high-speed switches.

Some broadband management products are starting to find their way into carrier services. British Telecommunications (BT) now offers such an application with several of its services. AT&T also plans to support SNMP for customer access to its Interspan ATM management product, expected to debut next year. BellSouth is preparing trials of high-speed network management capabilities. Some of these services, such as AT&T's, will permit users to deploy their own SNMP management stations to view and even configure activities on carrier high-speed WAN services.

Standard Issues

Although most broadband switch vendors are slapping the SNMP-compliant label on their products, their endorsement of the standard isn't exactly wholehearted. Until very recently, vendors of sophisticated WAN gear didn't give much thought to the Internet-derived protocol. New SNMP management information bases (MIBs) and security features, as well as promised improvements in the forthcoming SNMP 2, have increased SNMP's acceptance as a way of managing high-speed WAN equipment, at least among users. Most switch vendors are responding to user demands for SNMP support, but they don't believe the protocol has the speed, security, and reliability needed to manage large networks incorporating high-speed WAN technology.

The ISO-approved CMIP has long been suggested as a heftier, more flexible alternative or complement to SNMP. On the user side, CMIP has a strong following among

LOCATION OF SWITCH CONTROL†	LOCATION OF SNMP AGENT	PROTOCOL SUPPORT	MANAGEMENT TYPE	THIRD PARTY PRODUCTS SUPPORTED
Switch	Switch	SNMP	Centralised or distributed	DEC Polycenter Framework, HP OpenView, Sunnet Manager
Switch	Switch	SNMP	Distributed	None
Switch plus central 4602	No SNMP Agent	Proprietary	Centralised	None
Switch plus central 4602	No SNMP Agent	Proprietary	Centralised	None
Switch	Switch	Proprietary, IBM Network Management Vector Transport (NMVT), SNMP	Centralised or distributed	None
Switch	Strataview Plus software	Proprietary, SNMP	Centralised or distributed	DEC Polycenter SNMP Manager
Switch	Strataview Plus software	Proprietary, SNMP	Centralised or distributed	DEC Polycenter SNMP Manager
External CMS software	External CMS software	Proprietary, SNMP	Distributed	SynOptics Optivity software on Sunnet Manager
Switch	Switch	SNMP	Centralised or distributed	HP OpenView

both carriers and US government agencies. Bellcore, the research and development arm of the regional Bell operating companies, endorses CMIP for high-speed carrier networks and SNMP for customer access to those networks. The Network management Forum, a consortium of carriers, users, and vendors, is promoting the use of CMIP for a variety of network management functions, including carrier network management. Several WAN equipment makers, including BBN Communications, General Datacomm, Netrix, and Newbridge have lined up behind CMIP as well. "We believe users will progress from SNMP to SNMP 2 to CMIP," says Jonathan Reeves, Director of Systems Architecture at GDC. Even though SNMP 2 goes a long way toward improving SNMP for use in high-speed networks, users still will benefit from the greater reliability and more detailed reporting capabilities of CMIP, he says.

So far, however, most support for CMIP hasn't gone beyond the lip-service stage. The protocol is relatively new; vendors, users, and carriers are still hashing out definitions of managed objects using CMIP.

Some observers believe that those who endorse CMIP in theory may not be ready to follow up in practice. "CMIP's extra functionality comes with additional costs that make it less attractive than SNMP for many implementers," says Brian Button, Director of product marketing for Stratacom. CMIP hasn't been adopted by the makers of broadband switching gear, even those who supply telephone companies, notes Steve Barnhart, Vice President of marketing and sales at Applied Computing Devices. Most carriers continue to use Bellcore protocols like Transaction Language 1 (TL1) to monitor switch performance in their nets. "All the new Sonet switching equipment supports TL1," Barnhart notes. Because it is expensive to implement, Barnhart wonders whether CMIP agents will ever be widely used in high-speed switching devices.

To extend SNMP to cope with high-speed services and to ensure wider implementation of CMIP, users, carriers, and vendors are working with several standards bodies. These efforts have started to yield MIBs which provide specific definitions of broadband services and network devices that can be managed by an SNMP or CMIP management system. The Internet Engineering Task Force (IETF) has devised several MIB modules that can be used to handle high-speed network services from SNMP management consoles. The DS-1/DS-3 MIB, for instance, can be incorporated to track physical activity on a leased line, while the SMDS MIB and, in the future, MIBs for ATM or ISDN handle upper-layer services.

SNMP Approaches

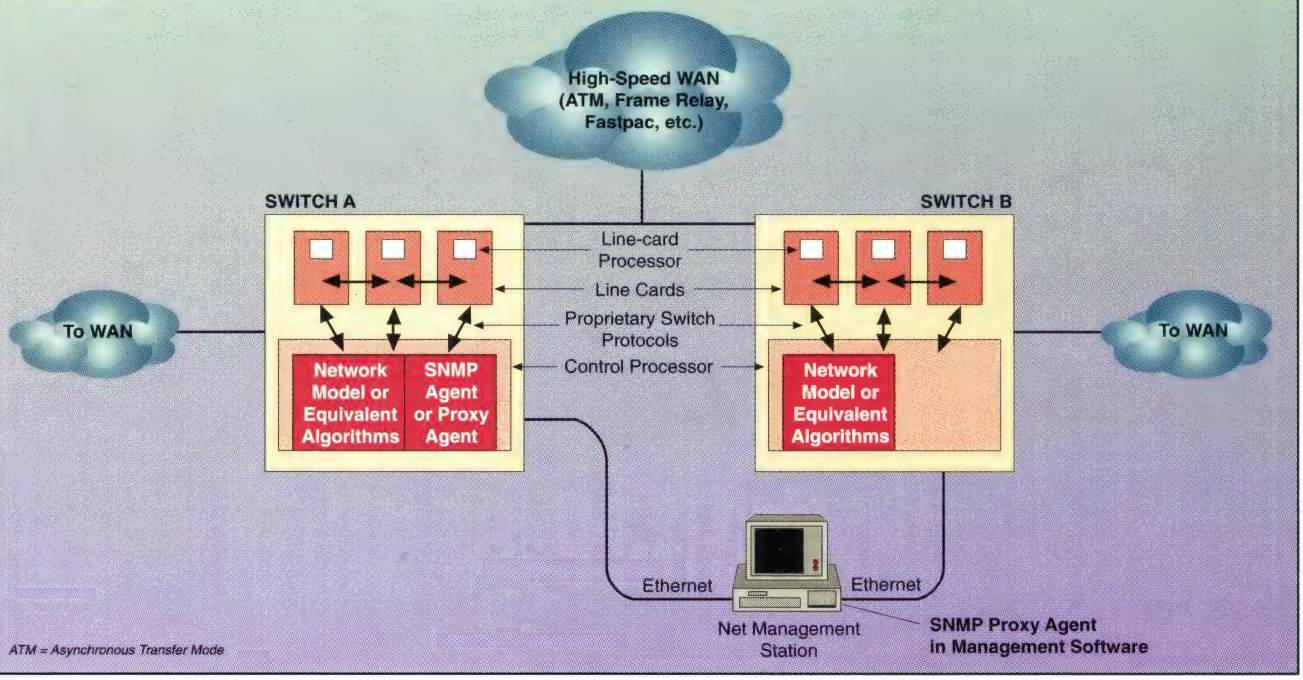
To achieve the speed and efficiency required to handle activities in virtual networks, most switches deploy proprietary protocols to control network operations. Functions like call setup, dynamic rerouting, and congestion management take place automatically inside switches, and among groups of switches. To have network status information displayed on SNMP management stations requires conversion of management data from proprietary formats to SNMP.

Some vendors convert switch information to SNMP inside the switch, while others do the conversion outside the switch (see Figure 1 on page 94). For example, in its Planet packet and cell switch now under development, IBM intends to place SNMP software directly inside the switch, while Stratacom will rely on external software to convert proprietary management information to SNMP.

Software to translate proprietary management data to SNMP is called a proxy agent. Standard SNMP agents take a device itself, with no translation required. It's easy to spot proxy agents that consist of external software packages running on workstations attached to high-speed switches. But agents located inside switches function identically to standard agents for the user.

Two Paths to Managing High-Speed Switches

In high-speed switches, control processors coordinate dynamic functions like call setup and congestion management for the switch's line cards and line-card processors, which in turn gather and process management information using reference models of the network or equivalent algorithms. SNMP data can be gathered inside the switch (Switch A) or by external proxy agents (Switch B).



Switch makers are taking a number of approaches to adding SNMP support. Canada's Northern Telecom plans to make its SNMP support optional. While most switch vendors already offer dumb terminal access as an alternative to SNMP management, Northern Telecom will go further, offering application program interfaces (APIs) for users who want to develop SNMP proxy agents for Northern Telecom's Magellan switches.

Proxy agents also will use different techniques to gather information from the switches they support. IBM will provide an SNMP proxy agent in its Planet switch, but it will use proprietary high-speed adaptors and protocols to handle virtual network configuration and fault management inside the switch. These adaptors will gather statistics about network activity and feed this information to a central 'control processor' inside each switch. The control processor will use a model of the network, or the algorithmic equivalent of a model, to keep information about its own configuration and that of other switches in the network up to date. The control processor's SNMP proxy agent will convert this configuration information into SNMP format and send it to an attached management system on an RS/6000.

Centralised or Distributed?

Vendor approaches also vary according to the degree of centralisation being built into their switch management offerings. NET/Adaptive says its Broadband Operations system, which manages its ATMX switch, can handle multiple switches, but users often want to assign more than one console to a network — to provide access to various groups of employees, for example. Newbridge, in contrast, gives users a variety of network views from its 4602 Mainstreet Intelligent Management Station, but the management system is strictly centralised.

Netrix plans a particularly clever strategy to distribute SNMP management, cut down on polling, and provide as much SNMP information as possible to a central management station. The vendor plans to put SNMP management station software inside the high-speed packet switches it's currently developing — but not to manage the switches. Instead, SNMP will be used to gather information about attached IP devices. The switches will use proprietary protocols to communicate with a central Netrix management station, which will convert the data to SNMP as well as gather SNMP data about the IP devices. The Netrix station will then act as an SNMP agent to third-party SNMP systems like OpenView from HP.

Like makers of packet and cell switches, T3plus has built SNMP support into its BMX45N T3 circuit switch. But T3plus adopted SNMP for slightly different reasons. As a circuit switch, BMX34N relies on time-division multiplexing to configure networks; this function is more effectively controlled from a central management system, the vendor says. If a connection fails, the switch relies on SNMP for reconfiguration: it automatically issues an SNMP trap message to the central management station, which responds by rerouting traffic over a new circuit.

T3plus had to adjust SNMP to suit high-speed circuit switching. For instance, the vendor had to come up with a way for a station to handle multiple configuration requests from attached switches. Most SNMP systems rely on a common address table to track network devices and can't cope with switches that may dynamically reconfigure that table at different times from different locations. T3plus solved the problem by allowing a management station to use the SNMP 'Get' command to reserve extra address space in the system's software in anticipation of the need for dynamic circuit changes.

Outside Help

As switch vendors work on management standards for their equipment, providers of network management platforms are trying to develop applications that can support high-speed switches. Most vendors appear to be working toward management platforms that handle both SNMP and CMIP, on the assumption that both protocols probably will be used to access carrier services. This support should enhance the ability of management systems to work with public network equipment as well as high-speed access switches on customer premises.

Among the internetwork management system vendors that now support CMIP over OSI protocols are HP, Digital Analysis, and DEC. Netlabs plans to add CMIP support over OSI protocols soon.

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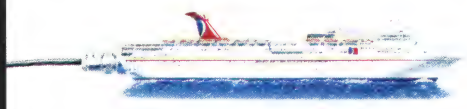

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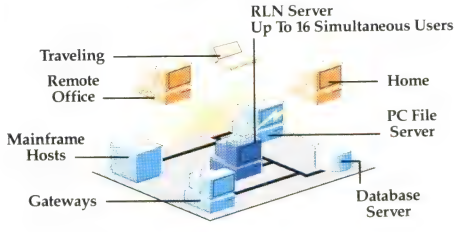

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"Carriers tell us they require systems that support both SNMP and CMIP," says Elizabeth Nichols, President of Digital Analysis. "They want SNMP for customer management, but they want CMIP to handle their own equipment." Nichols says that one carrier has cited the need for an object request broker to manage the SNMP or CMIP definitions used in the object-oriented database of OS/Eye*Node, the Digital Analysis management package. This kind of technology will be required for systems supporting tens of thousands of devices in high-speed networks, Nichols adds.

Digital Analysis recently announced it is developing a management application that interacts with the object request brokers offered by Hyperdesk. Opencon Systems, a company that developed software for the embedded systems used in Sonet multiplexers from Fujitsu, plans to release a Unix-based management system capable of handling multivendor equipment and supporting both CMIP and SNMP. The CMIP support could be used to manage equipment like digital cross-connect systems in the carrier network while providing an SNMP interface to customers' own internetwork management platforms, the vendor says.

Carriers and service providers are incorporating systems like these to help customers manage high-speed networking services. BT offers a Bandwidth Manager application for its Concert net management system to monitor multiplexing gear from Ascom Timeplex, Fujitsu, NET, Newbridge, and Telematics International.

BT offers Bandwidth Manager with three of its services: managed Private Network, Managed Links, and Flexible Networks. Bandwidth manager uses the Network management Forum's Omnipoint 1 definitions of managed objects in high-speed networks to record network status details, such as when bandwidth is available from specific multiplexers. This information is entered as an object in Concert's database, and is recognisable via CMIP by other systems. Any CMIP-compatible system will work with Bandwidth manager. BT also provides a link to IBM's NetView Info/management database so that information about virtual private networks can be shared with NetView. The NetView connection requires the use of IBM's Problem Management Bridge software.

Unix Power

Providers of management systems have a bigger problem than incorporating CMIP: Existing platforms simply are not powerful enough to handle the special performance, configuration, fault management, security, and accounting requirements of broadband switches. Because of their size and geographic scope, high-speed WANs deliver more link-level management information than router-based internets and LANs do. For instance, frame relay packets contain such link-level data as backward and forward explicit congestion notification (BECN and FECN) and discard eligibility bits. All this information is needed to produce statistical reports on the overall health of a high-speed WAN. Processing it in a timely fashion requires more firepower than many of today's internet management platforms can muster.

To address this problem, switch vendors have begun porting their management software to more powerful workstations. Some, such as Stratacom, are adopting Unix workstations to get more power for processing performance data, adding Ethernet connectivity between the workstation and the switch to gather this information from switches more quickly. This approach allows switch management software to track bandwidth utilisation in high-speed networks, which in turn lets users gauge the overall value of a network service.

Such capabilities take on special significance in high-speed WANs. In frame relay networks, carriers guarantee customers a committed information rate (CIR), generally the maximum average data rate of a circuit. Users need to be able to measure how well the overall bandwidth utilisation matches the CIR to assess the carrier's quality of service and to evaluate CIR levels in general.

Both the Strataview management system from Stratacom and the 4602 Mainstreet Intelligent Network Station from Newbridge let users compare actual traffic levels in high-speed networks with carrier CIRs or access classes. Both systems let users enter performance data into SQL databases, allowing users to produce reports about service levels delivered on a broadband net.

Switch management systems that use object-oriented software and SQL databases can provide selective views of networks. Eventually, they will be able to accommodate more sophisticated applications by allowing integration of information from many separate applications. Software that ties performance information to databases containing the costs imposed by carriers for network usage is one such possibility.

In Search of Broadband Standards

The following are summaries of efforts by standards bodies to develop techniques for managing WANs and WAN services based on high-speed switches:

- **ANSI** — Several committees of the American National Standards Institute are at work defining broadband management for various types of high-speed networks. The committee that is reportedly in charge of most management work is T1S1, whose charter is to develop standard interfaces to broadband ISDNs.
- **ATM Forum** — In March, the ATM Forum announced the formation of a technical committee subgroup dedicated to studying network management specifications. Forum representatives say this group will attempt to build on existing standards, such as SNMP and CMIP, instead of devising new ones. The group plans to start work in July.
- **Bellcore** — The research and development arm of the regional Bell operating companies (RBOCs) has a series of specifications that incorporate CMIP for managing carrier switching gear and SNMP for customer interfaces. The Bellcore publications comprise either Technical Advisory (TA) or Technical Reference (TR) documents. Significant TAs include TA 1062 for Switched Multimegabit Data Service (SMDS) and TA 1248 for asynchronous transfer mode (ATM) switching, in which Bellcore endorses the use of SNMP MIBs from the internet Engineering Task Force for customer interfaces to high-speed RBOC services. Before the end of this year Bellcore plans to release TA 1117, specifying customer network management requirements for cell relay services like ATM.
- **European SMDS Interest Group** — This industry consortium, which includes representatives from all European PTTs, has approved a document that Bellcore says is identical to its TA 1062. Differences include the substitution of E1 and E3 terminology and rates for US DS-1 and DS-3.
- **IETF** — The Internet Engineering Task Force has created several management information bases (MIBs) for managing high-speed services, including the MIBs for physical DS-1 and DS-3 connections, the services that operate over DS-1 and DS-3 connections, and specific SMDS features that use these connections. The IETF is also looking at working groups for Synchronous Optical Network (Sonet) and ATM MIBs. The Sonet MIB would join the DS-1/DS-3 MIBs Network (Sonet) and ATM MIBs. The Sonet MIB would join the DS-1/DS-3 MIBs among the other modules for defining physical-layer connections, while the ATM MIB would provide specific service definitions that use these connections.
- **Network Management Forum** — The Forum has several initiatives under way that should help the management of high-speed networks. But the group says that none of its efforts are dedicated exclusively to managing these networks.

Mary Jander

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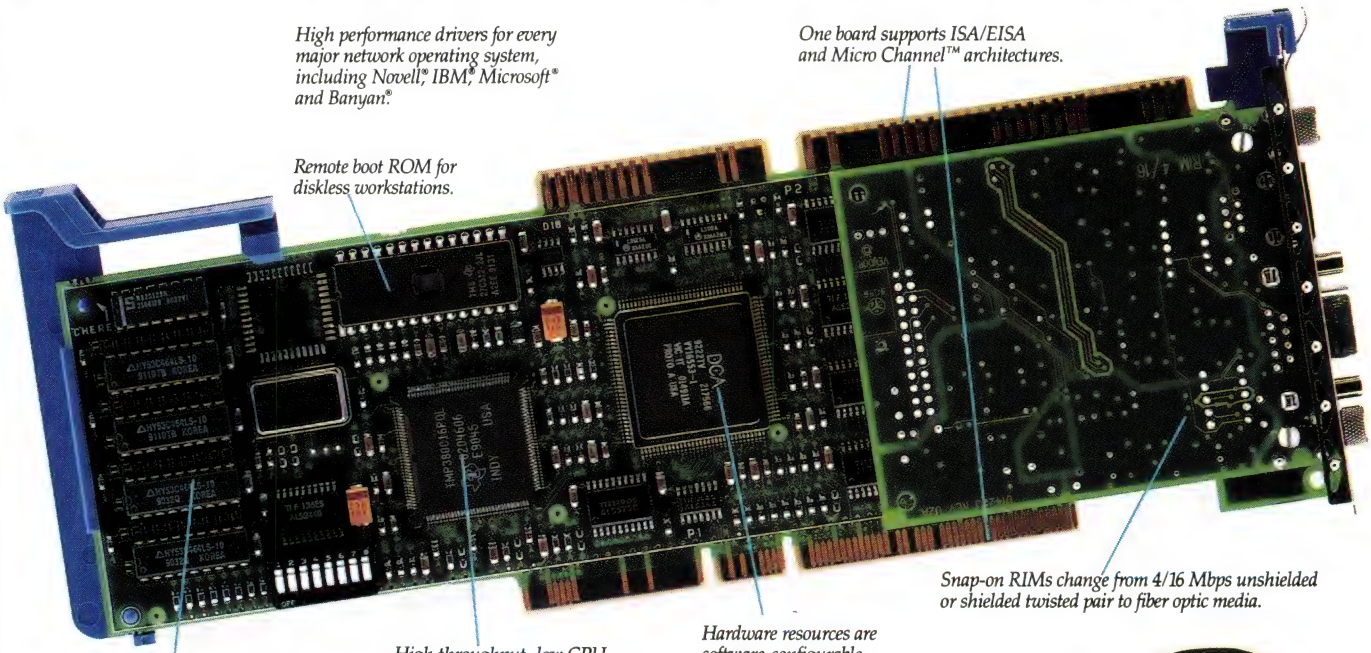

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High-speed packet and cell networks have special configuration problems stemming from their reliance on virtual connections that change dynamically. Furthermore, bandwidth on one line often is multiplexed or rationed across several devices or circuits. And all configuration changes in high-speed networks must take place in less than a second — a task that is handled by the switch and typically reported to the management system after the fact. Intertwined with configuration are fault management and security, the latter a critical issue in high-speed networks in which customer premises gear interacts with carrier central office equipment.

The biggest network problem encountered in high-speed networks is congestion, which can result from increased activity on the network. Since no confirmation or reordering of packets is required in most fast packet or cell-based networks, traffic that exceeds the guaranteed level of bandwidth can be dropped or lost. The switch then must reconfigure to reroute traffic and ensure the retransmission of lost packets.

In most switches, configuration and fault management are part of the network operations handled by the switch. Two switches use their own reference models, or algorithmic equivalents of reference models, to compute the best path between two sites in a virtual network based on network conditions. Changes in configuration are reported to the management system after the fact.

Newbridge builds a model of a network into each switch and management station on a network. To add specific broadband functions, Newbridge adds algorithms that augment the basic model. Object-oriented software is used to match up the particular network algorithms with the basic network model.

Newbridge also deploys this modelling technology to handle congestion in high-speed packet networks. When congestion hits a network that uses Newbridge equipment, the switches automatically fall back to a transmission rate at which packets won't be dropped. The Newbridge 3645 and 36150 Mainstreet switches also let users establish a queue so that when congestion hits, mission-critical traffic will be sent first and other traffic buffered, lowering the chance that important data will be lost.

More Control

Some vendors give users more control over the dynamic configuration of the network. Telematics, for instance, says it will furnish Unix applications compatible with HP OpenView for configuring the ATM cell switch it plans to release next year. This software will let users assign the speed and protocol used by a particular port on the switch. Line cards in the switch will be equipped with RISC processors and memory containing the necessary framing formats and clocking mechanisms for establishing ATM, frame relay, X.25, and other services from high-speed leased-line connections. In other switches, the switch itself will make these port assignments.

SynOptics says its Unix-based software, the LattisCell Connection Management System, will control call setup, automatic rerouting, and congestion management for multiple LattisCell ATM switches when they become available later this year. SynOptics will offer a separate Unix-based application, integrated with its Optivity series of hub management software, to provide performance reports and graphical views of the ATM network. This Unix application will function separately to facilitate automatic switch configuration and fault management, just as though it were contained inside the switch.

Mary Jander is network management and new products Editor and Johna Till Johnson is Senior Editor for Data Communications magazine. Both are based in the US.

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Apple's OCE — The New Way to Collaborate

Apple Computer's new Open Collaboration Environment is designed to let Macintosh users access network services from within whatever applications they're running.

The networking industry loves numbers: megabytes per second; MIPS (millions of instruction per second) on the desktop; milliseconds of response time. And network managers can be justifiably proud of their figures.

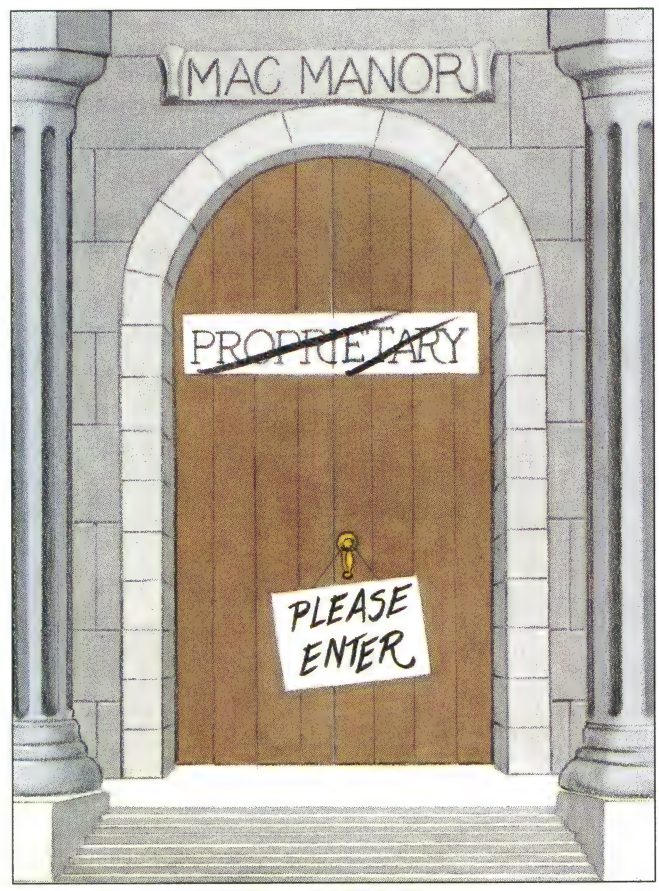
Putting Cray supercomputers on every desk and linking them with dedicated ultra-high speed pipes is not the best way to make sure users get the most out of a network. In fact, the industry's obsession with personal productivity often seems to miss the point, since *interpersonal* productivity is a far more important (and elusive) goal. Simply put, conventional measures of network performance (like throughput and errored packets) are not enough. How effectively a network allows users to collaborate on projects is just as significant.

Consider even a rudimentary task, like sharing spreadsheets. Users can't just send documents from within the applications that created them. Instead, they've got to quit the application, launch a mail package, create a new document, attach the spreadsheet, and then ship it over the network to some lucky colleague who gets to reverse the process. And mail packages are touted as network-enabled technology!

Apple Computer says there's a better way to work together — its Open Collaboration Environment (OCE). In essence, OCE is a set of APIs (application program interfaces) and software modules that enable applications to communicate. Among other things, the technology embeds network services like e-mail and fax within the Macintosh System 7 operating system. That makes it possible to mail a Lotus 1-2-3 spreadsheet, say, or a QuarkXpress file right from the Mac desktop, without quitting the application that created the document.

OCE also addresses other issues that now stand in the way of effective collaborations. It establishes a single directory of network users and services (again, available from the Mac desktop), and presents it in a consistent format. And it gives users a way to authenticate documents with encoded signatures. This should go a long way toward making it possible to transmit legally binding documents, like purchase orders, over a network.

In fact, OCE is one of five APIs battling to control the link between users' applications and the message transport process on LAN platforms. Other contenders include: the Vendor Independent Messaging (VIM) API, backed by a consortium led by Lotus Development; the Messaging Application Programming Interface (MAPI) developed by Microsoft; the Common Mail Calls (CMC) proposed by the X.400 Applications Programming Interface Association (XAPIA); and the Standard Message Format (SMF) developed by Novell (see 'Delivering E-Mail for the Enterprise,' *Australian Communications*, April 1993).



Significant Others

The Open Collaboration Environment, which is slated to ship shortly, will be made available both as an upgrade to System 7 and as additional modules from Apple Computer and third parties. For

end-users, the upgrade promises to make collaborations far simpler by virtue of integrated communications and ready access to standard directories of network users and resources.

For network managers and software suppliers, Apple's OCE promises speedier development and delivery of network-aware applications.

Third-party developers have already demonstrated a healthy interest in OCE, and Apple has promised a whole suite of access modules and compatible applications along with the main product rollout or soon after. At the time of going to press, the Mac maker has yet to go public with the names of OCE partners, but the list doubtless includes industry heavyweights like Adobe Systems, Lotus Development, Microsoft, and Quark; as well as smaller, specialised vendors.

From the services that Apple says it plans to deliver, it also looks as if OCE has caught the interest of heavyweights Novell and IBM, which reveals something essential about the computer maker's strategy. OCE is very much intended to be a cross-platform environment, and Apple wants to make sure that OCE-enabled collaborations encounter few restrictions.

The success of OCE, of course, also largely depends upon whether a broad range of third party developers climb on board the bandwagon and bring on-line full-featured implementations. While there's no way to guarantee this, Apple's track record with third-party software suppliers is fairly impressive. Its Data Access Language syntax for SQL databases, for example, is widely supported.

It should be noted that other vendors also are readying technologies that allow applications to collaborate. Microsoft, for instance, has defined the Windows Open Systems Architecture (WOSA) which is designed to allow Windows applications to connect with other network services.

Today, WOSA includes Open Database Connectivity (ODBC), a tool for database connectivity which aims to provide simpler connectivity to many relational databases on the market; MAPI for mail-enabled applications; Windows Sockets; MS-RPC; Windows SNA; and some vertical-market APIs (for the insurance and banking industries). Basically, WOSA delivers many of the features and functions of the Open Collaboration Environment, but Microsoft seems to be more interested in defining a series of interfaces to a broad range of back-end services.

Digital Equipment Corporation is also now pursuing new collaborative applications with its Network Applications Support (NAS). While NAS delivers many of the APIs and services found in OCE and WOSA, it's really more of a grand strategy for interoperability and cross-platform connectivity at all levels of computing. Besides collaboration and messaging, NAS also specifies protocols and operating systems and addresses such issues as compound document architectures across diverse platforms and applications.

The Layered Look

OCE consists of three layers of interlocking services (see Figure 1 on page 101). At the lowest layer are the system software managers, which deliver three primary services: messaging, directories, and security.

The Interprogram Messaging (IPM) Manager furnishes store-and-forward messaging between applications. The Directory Manager is a database that contains lists of users and network resources (such as printers, file servers, and hosts) that can be arranged by arbitrary identifiers (such as phone numbers, workgroups, even pictures). The Authentication Manager and Digital Signature Manager take care of document and signature encryption.

The middle layer includes the collaboration packages. The Standard Mail Package

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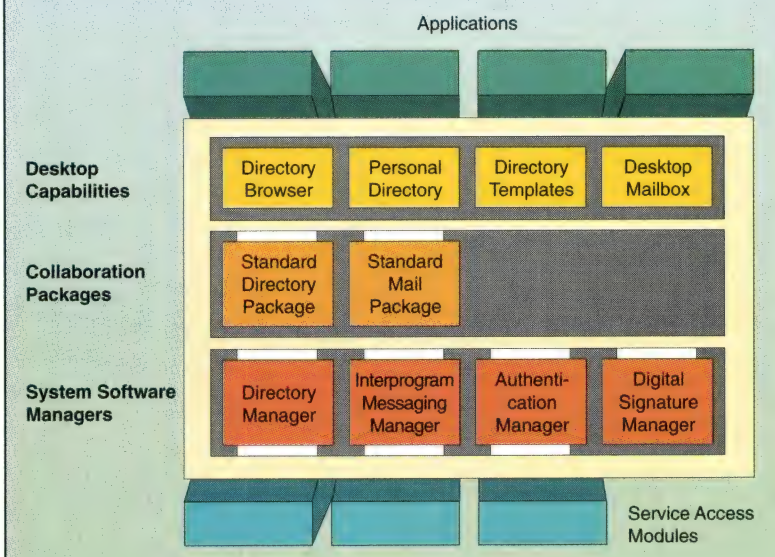
(SMP) and Standard Directory Package (SDP) are prepackaged routines for common services that users may wish to add to applications, such as dialogue boxes for selecting addresses, adding attachments, and authenticating documents. SMP and SDP allow users to send a document from any application as an e-mail message. SDP searches for a destination address on a network by tapping System 7's Finder directory lookup feature. Additionally, SMP and SDP will support X.400 and X.500.

Making these routines available to third parties will streamline the development of OCE applications. It also helps ensure that applications will have a common look and feel. All the routines are 'standard' in the sense that they are the only ones OCE makes available to networked users.

At the top layer of the model are the desktop capabilities, which serve as the front end for OCE. These are the actual interfaces to the collaboration packages. For example, the Desktop Mailbox and Directory Browser icons are used to send mail and access directories.

Figure 1: Inside Apple's OCE

Open Collaboration Environment comprises three closely linked tiers. System software managers deliver primary services such as mail and directories. Collaboration packages allow users to integrate these services into their applications. Desktop capabilities are the actual interfaces to the services.



Getting the Message

One of the ways that the Open Collaboration Environment enables users and applications to collaborate is by establishing a standard messaging service. In essence, different applications make use of the messaging service via APIs within IPM Manager. APIs associated with other system software managers address various aspects of application-to-application communications.

The real strength of the IPM Manager is not that it's more robust than any other messaging engine but that it establishes a standard that can be used by diverse applications. This could prove very attractive to software developers looking to create add-on products that enhance existing services. These might include packages that monitor a wire service or a stream of incoming faxes for key words (such as the name of a client or vendor). It's equally possible to use IPM Manager to route documents from location to location, across different electronic-mail systems. Thus, medical records could 'follow' patients electronically as they move from one doctor's office to another for a series of tests.

Additional application programming interfaces — written both by Apple and by third parties — are contained in the Service Access Modules, or SAMs (see Figure 2 on page 102). SAM APIs are used to translate between an OCE service and other services: for instance, between OCE and Microsoft's MAPI messaging service. The SAM APIs are responsible for taking care of plugging OCE into a foreign messaging, directory, or authentication computer system.

Among other things, this makes sure that OCE's directories are always up to date. Apple is supplying SAMs that handle peer-to-peer dial-up, as well as peer-to-peer access to AppleTalk LANs and remote OCE messaging systems. Apple or other vendors could create modules that link to messaging services based on X.400 or Novell's MHS (Message-Handling Service), to name just two possibilities.

As noted, OCE also makes it possible to remain within an application while accessing functions associated with other programs, thanks to its Standard Mail and Standard Directory packages. Users can merely click on the correct mailbox icon or Directory Browser to call up a complete list of correspondents, for example, or a shared directory that includes data gathered by the SAMs.

With these icons, e-mail is reduced to a SEND command in an application. This is obviously far more convenient than getting mired down in all the procedures associated with exiting one application and launching a mail program. Furthermore, OCE eliminates the need to translate a file into a format (fax, ASCII text, e-mail attachment) that the communications service can work with.

These extra steps slow down and distract people who are trying to get their work done, forcing them to deal with the network rather than merely take advantage of it. Putting an end to that sort of struggle is what OCE is all about.

Another way OCE enables applications to collaborate is by consolidating directory information. Most network administrators would rather find directory entries in one place — displayed in a uniform manner — than have to oversee multiple directories, each with its own conventions. But most directories are extensions of the service they represent and offer no way of accessing directories associated with other applications. What's more, directories offer a predefined (hence, limited) set of functions.

OCE unifies directory services, allowing them to operate independent of the services they support. Access to external services is furnished by SAM APIs. The Directory Manager consolidates this data, translates it into a common format, and establishes a unified database for all OCE-enabled applications.

Keeping Secrets

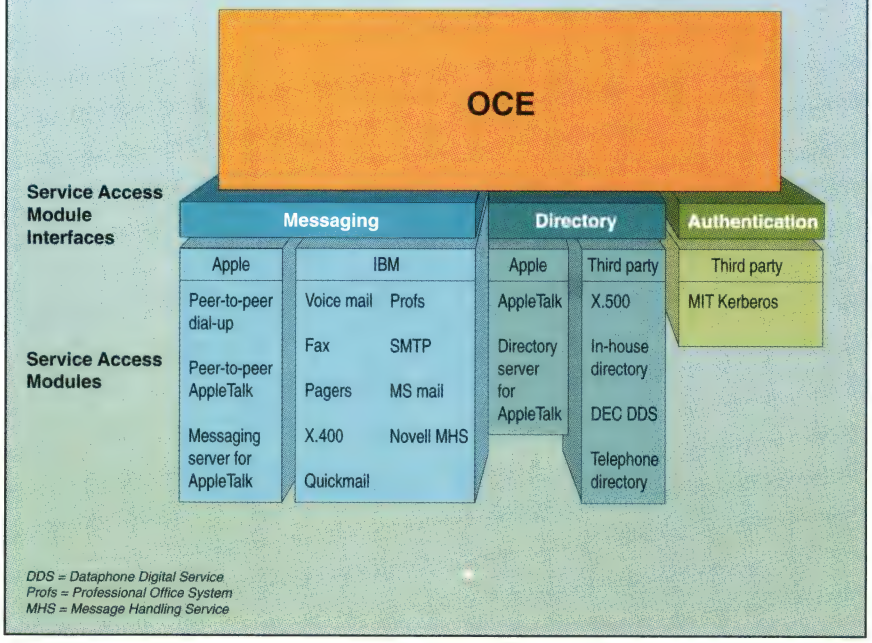
OCE also allows users to encrypt both documents and electronic signatures to send sensitive documents across the network. This feature is particularly useful in a workflow application, in which different members of a project need to sign off on processes and procedures. Right now, the necessary paperwork usually has to be distributed, tracked, and filed — a cumbersome approach best suited to the 19th century.

OCE's authentication and encryption relies on the RC4 data encryption algorithm licensed to Apple by RSA Data Security. RSA supplies public key encryption technology to virtually every hardware and software supplier that furnishes this sort of security, including IBM, Microsoft, and Novell.

To provide protection against wire-tapping, the documents themselves can be encrypted before being sent over the network. Users also can add a digital signature to a

Figure 2: SAM I Am

The Service Access Modules (SAMs) contain the APIs that are used to plug OCE into foreign messaging, directory, or authentication systems. Apple is furnishing access modules that handle peer-to-peer dial-up, as well as peer-to-peer access to AppleTalk LANs and remote OCE messaging systems.



document by dragging it to the signer icon. The RSA authentication system works by creating a pair of 'keys' or numerical sequences for each user who creates a document. The keys, in turn, are used to generate a unique digital 'fingerprint' for each protected message or file. RSA's fingerprinting technology uses an algorithm that generates a unique number based on the contents of each message. RSA say the chances that two documents will produce identical numbers are lower than the odds of two people having identical fingerprints.

Under RSA's public-key method, users are given two keys: a private key they must keep secret and a public key for free distribution. Because a public key distributed by one user can decrypt only fingerprints created with the same user's private key, recipients can prove what they receive was sent by the owner of the private key. Once again, digital signatures can be added from within any application. There is thus no need to launch a special encryption program to safeguard a document.

For the user, the benefits of OCE will be seen when all of its communications services are brought together in a single application, such as a third-party conferencing package. In many of these packages, conferences are organised as bulletin boards dedicated to particular topics. Users add their comments to these bulletin boards in sequential order to create a running discussion. Comments can have attachments that include documents, sound, and graphics. And users can even be notified automatically when a new comment has been added to a topic they're interested in.

Incorporating this sort of application into OCE can extend its powers significantly. The Standard Mail Package allows users to send their comments and attachments to anyone listed in the OCE directories — whether or not they participate in the conferencing application. What's more, by integrating the conferencing package's directory into OCE's Standard Directory Package, all of its bulletin boards, topics, and users become part of the Open Collaboration Environment's universe of resources. Users registered with the conferencing package can see all of OCE's services, while users outside of the application can still send mail to conference participants.

Best of all, the Open Collaboration Environment is a real product. It's not an architecture. It's not vapourware. Developers will soon be able to buy code and plug real services into OCE, a very big step toward seamless access to all network resources.

Peter Coppola is the Director of Groupware Marketing at Pacer Software. He is based in Westborough, Massachusetts.

In the November edition of

AUSTRALIAN communications

FRAME RELAY

While in some eyes frame relay is in danger of being consigned to the status of 'last month's networking fad,' the technology is gaining more and more adherents. In our next edition we take a close look at frame relay network design issues in Australia.

WORKGROUP COMPUTING

Windows for Workgroups and Lotus Notes may be designed around it, but what exactly is workgroup computing? Next month we take a detailed look at the concept, the products involved and the position of the leading networking vendors.

A WORLD OF STANDARDS

ETSI, CCITT, ISO, ANSI, IEEE, OSF — Why are there so many world standards-making bodies and what do they all do? In our next issue we take a look at the roles of the various standards groups and the sometimes confusing relationships between them.

THE OSF'S DME

DME, the Open Software Foundation's Distributed Management Environment, is an attempt to define a vendor-independent distributed platform for network and system management. Next month we examine its prospects and how it compares and contrasts with OSI.

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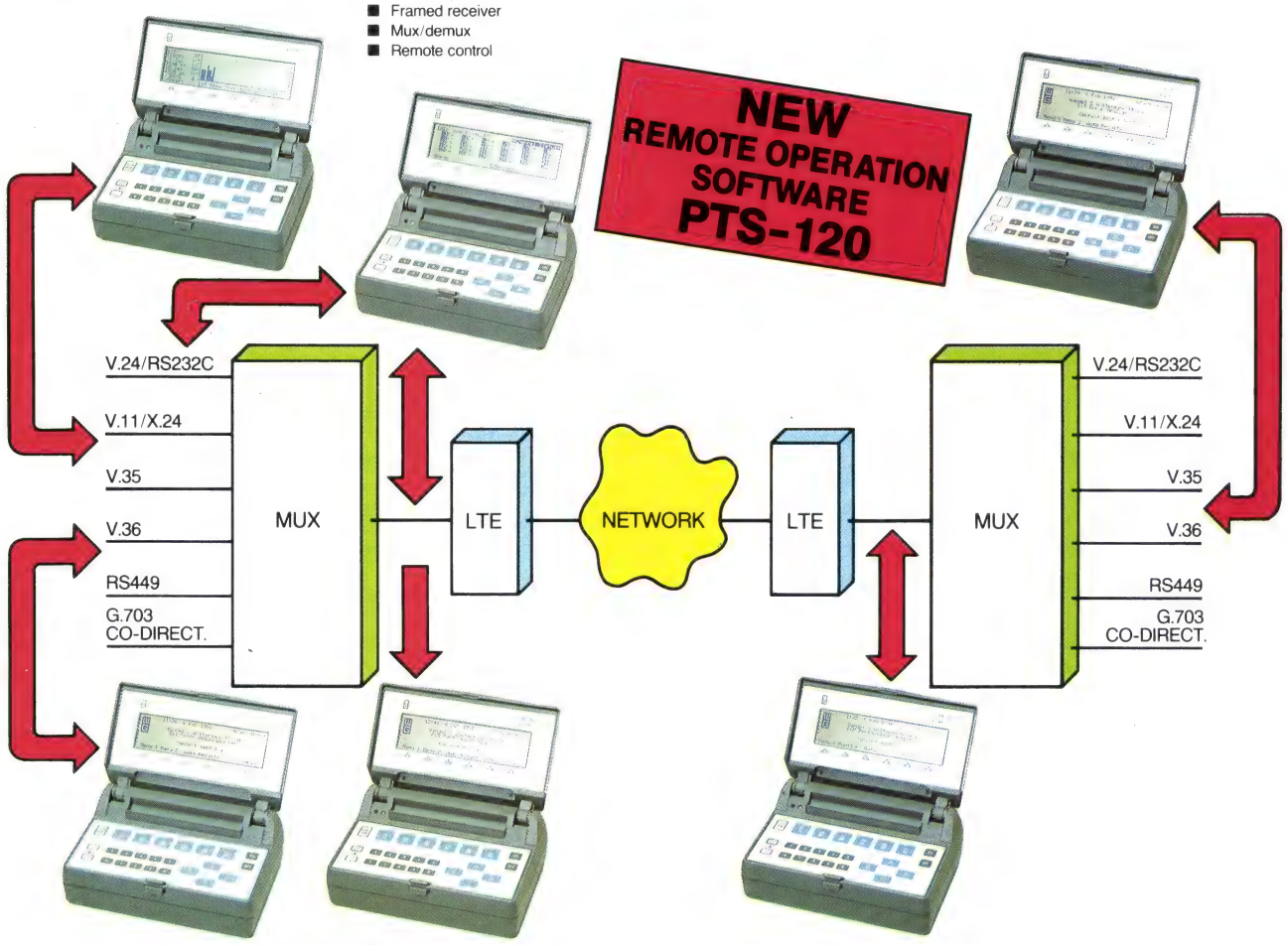

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Fast Print Server

Intel has introduced its NetportExpress XL Print Server, a high-performance three-port network print server which provides centralised management of distributed printing resources.

The new product has two parallel ports and one serial port which simultaneously support any three printers connected directly to a NetWare LAN. There is also built-in simultaneous support for multiple protocols including AppleTalk and TCP/IP, with Microsoft LAN Manager and Windows NT support due to be available by the end of the year.

The NetportExpress XL has 128K of built-in flash memory and 1Mb of RAM, as well as its own processor that will enable users to add new features via software upgrades. It offers up to 180Kbps throughput on a single port, can handle up to eight file servers and 32 print queues, and will support NetWare encrypted passwords. The unit's parallel ports comply with the IEEE 1284 high-speed bi-directional specification, and it will support both the Hewlett-Packard and Network Printer Alliance (NPA) bi-directional printer management protocols and software by the end of the year.

The NetportExpress XL includes auto-sensing connectors to support Thinnet and 10Base-T wiring, and is priced at $1,095, excluding tax.

Intel (02) 975 3300

Combined Router/X.25 Switch

Newport Systems has announced the XCI Enhanced 2.0 combined PC card router and X.25 call switch. Officials said the XCI Enhanced 2.0 is a NetWare-certified X.25 interface which supports multiple NetWare services — including NetWare for SAA, which provides X.25 connectivity to IBM hosts and AS/400 systems.

The X.25 Enhanced 2.0 allows PCs and X.25 communications equipment to share a single XCI Enhanced 2.0 and X.25 line, which the officials said can result in significant savings on the cost of leased lines and communications hardware.

The card offers multiprotocol routing, allowing users to connect LANs over X.25 using IPX, TCP/IP and AppleTalk. Data compression, load balancing and multiple virtual connections to a single site enable users to make further savings on transmission costs, said the officials.

The Newport Systems XCI 2.0 Enhanced 2.0 is priced from $4,560, including tax.

LAN Systems (02) 901 3655

Compact Ethernet Bridge

CTEC Communications Technology has announced the release of the new Gandalf LANline 5210 Micro Ethernet Workgroup bridge. The new bridge is the size of an audio cassette, operates at full Ethernet rates, and allows LANs to be segmented to reduce backbone congestion, said officials.

It is powered from the attached AUI-based device, such as a hub or repeater, which eliminates the need for additional power outlets or external power transformers. Diagnostic LEDs are provided for troubleshooting and management. The LANline 5210 is priced at $1,295.

CTEC (02) 975 4722

The NetportExpress XL provides 180Kbps throughput on each port

SynOptics Melds 10Mbps/100Mbps Ethernets

SynOptics Communications has announced two new local area network technologies that the company says will let customers build higher performance Ethernet networks and gradually integrate asynchronous transfer mode (ATM) technology.

The new Fast Frame and CelliFrame technologies will help users build switched LANs which provide each user with the equivalent of a private network connection instead of shared access to the network.

The Fast Frame technology is incorporated in a set of Application Specific Integrated Circuits (ASICs). The chip set will be used in new products, including a module for the System 3000 intelligent hub that will combine 10Mbps and 100Mbps end-stations on the same switched Ethernet network. Fast Frame provides all the switching and Media Access Control (MAC) layer functions required for switched Ethernet networks with both 10Mbps and 100Mbps connections, with a total switching capacity of two gigabits per second. It enables a switch that can support 10Mbps Ethernet as a single-station-per-port or an Ethernet segment-per-port. The 100Mbps Ethernet solution can be implemented as links to servers, routers or individual workstations. Connecting to 100Mbps Ethernet requires a new adaptor card in the attached station.

SynOptics' new CelliFrame technology translates between Ethernet frames and ATM cells. The frame/cell translation allows Ethernet workstations to communicate directly to ATM-linked devices on the same network. Combined with Fast Frame technology, this new technology will enable the development of switches that offer 10Mbps Ethernet/100Mbps Ethernet/ATM capability, company officials say. The company plans to provide this combination on the module for the System 3000 in 1994, as well as in standalone products.

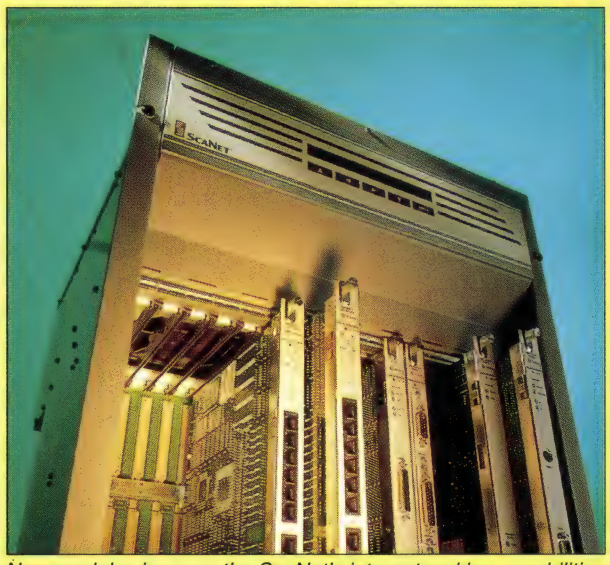
The company has also announced that it has started shipping its LattisCell ATM switch. The LattisCell switch is a standalone product, and the first to incorporate SynOptics' Fast Matrix ATM technology. It features 16 ports, each with 155Mbps dedicated bandwidth. There are two versions of the LattisCell — the Model 10102, which contains 12 STP ports for local connections and four fibre ports for connections of up to two kilometres, and the Model 10104, which uses all 16 ports for fibre connections. The switch is lightweight and compact, and is priced from $2,780.

Also announced recently was the new LattisEngine/486. The product is an intelligent device that distributes communications services — such as multiprotocol routing and SNA gateway services — and management capabilities throughout NetWare networks. According to SynOptics, the device, known as a network utility server, helps users make the transition from hierarchical network architectures to client/server configurations, where intelligence needs to be distributed throughout the network to maintain functionality, reliability and manageability.

SynOptics Communications (03) 853 0799

Ethernet Adaptors

Olicom recently released a new range of ISA Ethernet adaptors which officials from the company said combine a very high degree of software compatibil-



New modules improve the ScaNet's internetworking capabilities

Cray Integrates Token Ring in ScaNet Hubs

Cray Communications has launched a fully-IBM compatible Token Ring Control Access Unit (CAU) and a Lobe Attachment Module (LAM) for Token Ring networks.

The two products are available as modules for Cray's ScaNet System Centre Hub range. Modules for Ethernet and FDDI are already available, and officials said the new Token Ring additions make the System Centre Hub a truly integrated solution for interconnecting mixed networking environments.

Cray officials claim the ScaNet CAU is a fully IBM-compatible intelligent third generation wiring hub. It comprises concentrators for Ethernet and FDDI, multi-functional terminal servers and brouter modules. The hub allows connection of up to 80 Token Ring network lobes via ScaNet LAMs. Up to four LAMs can be attached to each CAU, and up to 20 lobes can be connected to each LAM. The ScaNet LAM module is provided in two versions — UTP and STP.

The CAU and LAMs support 16Mbps and 4Mbps Token Ring networks. The ScaNet CAU/LAM is manageable via IBM LAN Network Manager or any SNMP-based management system. Redundant power supplies and auto-partitioning features improve reliability, and both products feature compact design.

Cray Communications (02) 451 7535

ity with the fastest adaptor technology available. The adaptors include a coaxial BNC connector for direct connection to thin Ethernet cable, a DB15 connector for operation with an external transceiver (10Base5 or 10-BaseF), and an RJ45 connector for direct connection to an unshielded or shielded twisted pair cable.

All the adaptors have a 16-bit IBM PC bus interface, and include high-performance drivers for Novell NetWare, Microsoft LAN Manager, Windows for Workgroups, Windows NT, IBM's LAN Server, SCO Unix and AT&T Unix. They come complete with on-board boot PROM socket, and all configurations are software selectable.

Force Technology
(02) 971 1000

Banyan SNA Services

Banyan Systems has introduced its new Banyan SNA Communications Service (Banyan SCS), which provides fully integrated peer-to-peer communications together with connectivity to multiple hosts over a variety of host connections.

The product has been developed as part of the partnership between Banyan and Digital Communications Associates (DCA).

Based on the DCA/Microsoft Communications Server, the Banyan SCS combines the power of DCA's full-featured 3270/SNA emulation capabilities with Banyan's enterprise networking capabilities. It is an integrated Banyan network service that operates in conjunction with the StreetTalk III global directory and other enterprise network services.

The initial release of the product offers complete IBM emulation for DOS, Windows and OS/2 clients, with Macintosh support due by the end of 1993.

Banyan SCS provides application development tools to simplify the use of complex host APIs. Residing on a VINES for SCO Unix server, it is fully distributed and accessible across a Banyan enterprise network and runs concurrently with other network services.

It supports IBM standard SNA protocols and development tools (APPC for LU 6.2 applications; HLLAPI for 3270 applications; LUA) and incorporates a full range of SNA features including PU 2.1 node support over Token Ring, DSLC and X.25 connections, support for as many as 254 3270 sessions and up to 254 APPC sessions per service, access to NetView statistics and user alerts, Response Time Monitoring and logging and tracing facilities.

Banyan Systems
(02) 954 3228

NetWare for OS/2

Novell has released NetWare for OS/2 as part of its Branch Office Solutions strategy.

The product is a software extension that enables NetWare 4.01 to run in non-dedicated mode on a PC running OS/2 version 2.1. It offers all the features of NetWare 4.01 in the OS/2 environment, preserves NetWare 4.01 security, and allows hardware sharing of a non-dedicated server with the reliability of a dedicated server, said officials.

NetWare for OS/2 is priced at $380.

Novell (02) 413 3077

HP ATM Test System

Hewlett Packard has announced the HP 75000 broadband series test system for the development and testing of ATM and broadband ISDN (B-ISDN) networks.

The company claims the product is the first of its kind, and is the only test system to provide comprehensive testing of physical and ATM transport function, and seamless integration with the protocol testing of the ATM adaptation layer (AAL) and B-ISDN services.

The system is built around a modular architecture, and can be configured with any combination of SONET/SDH (155Mbps and 622Mbps), ATM cell-based (155Mbps), DS3 (45Mbps) and E3 (34Mbps) physical interfaces. Users can choose from a selection of protocol tests with full decode, emulation and simulation of ATM, AAL and SMDS, and a cell-processor architecture allows users to implement a fully bi-directional dual-port or multi-port configuration.

The broadband series comes in two different sizes. The rack-mount broadband series Form 13 uses a 13-slot VXI cardcage to support up to five test ports simultaneously. The broadband series Form 6 is a portable tester with dual-port configuration specially suited to field trials and remote testing. Both products offer identical functionality, but the Form 13 is more expandable.

Both the products are based around the HP-UX 9.0 operating system, and all of the protocol-testing software that runs on the HP 4200 broadband series executes directly on an embedded Unix system-based controller with an X/Motif user interface.

The HP 75000 broadband series test system (HP Form 13 and HP Form 6) is priced from $139,000, with price dependent on the interface configuration and number of ports required.

Hewlett-Packard 13 13 47

FEP Replacement

Network Systems Technology has released Central Site SNAC (CS SNAC), an SDLC-to-LLC conversion product for central sites, which links SNA/SDLC

lines to IBM host Token Ring networks.

Officials said the product has been developed by US-based Sync Research for IBM customers who want to replace their IBM front end processors without sacrificing current network management and availability.

The new CS SNAC is based around the communication software and hardware technology of Sync's SNAC/TRC. The hardware platform provides up to 28 SDLC connections, and features hot-swappable SDLC-to-SDLC conversion adaptors, a redundant load sharing power supply and a rack mount configuration.

The CS SNAC consolidates SNA/SDLC point-to-point and multi-drop lines to a central site Token Ring network, and is configured with up to seven SDLC-to-LLC conversion adaptors.

Each adaptor supports up to 16 downstream PU 1.0, PU 2.0 or PU 2.1 physical units, and is configured with up to four RS-232 or two V.35 SDLC lines. Multiple CS SNAC units can be connected to construct larger configurations.

Network Systems Technology (02) 957 3880

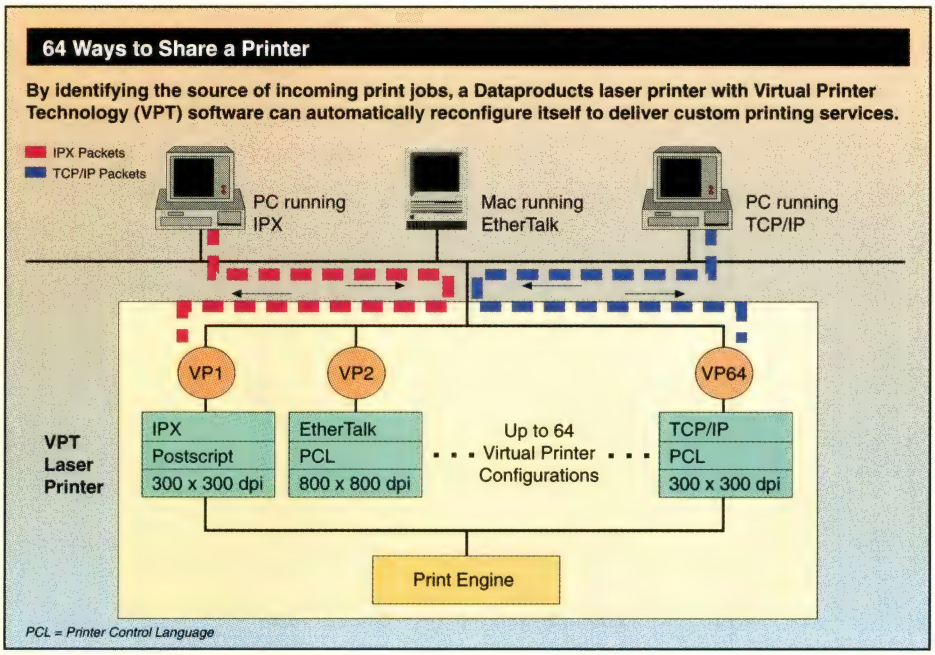
Three-Speed Modem

Banksia Technology has introduced its new MX-4S three-speed modem which features data compression and asynchronous or synchronous speeds of 300/300, 1200/1200 and 2400/2400bps. Officials from the company said that the CCITT V.42 error correction facility built in to the unit provides 100% error-free transmission.

The modem's data compression provides effective throughput of up to four times the uncompressed speed, giving almost the same speed as a more expensive 9600bps modem, the officials said.

It features auto-dial, answer and disconnect, call progress monitoring, extensive local and remote diagnostics and extra low power consumption. Additional features include: an inactivity timer which ends a call if there is no activity for a determined period; serial port speed lock, which accommodates devices that need fixed data speed, such as serial printers; automatic redialling rate control; asynchronous DTR dialling; three different password security modes; and remote configuration. Q-Modem software is also included, and company officials said the device follows the industry-standard Hayes AT Command Set. The MX-4S modem supersedes Banksia's earlier MX-4 model, and sells for $550 ex tax.

Banksia Technology (02) 418 6033



Taking the Pain Out of Printer Sharing

Sharing a common printer across a LAN often requires setup chores that please no-one. Now, to take the pain out of printer sharing, Dataproducts has developed a software-based technique called Virtual Printer Technology (VPT) for two of its laser printers.

Users need documents formatted in a variety of fonts and levels or resolution. This means that every time they send a document to a shared laser printer they must first reconfigure it for their individual requirements. Some PC-based applications have print drivers that let users do this remotely on the LAN, which can be a time-consuming task. Worse, some older DOS applications, like earlier versions of Lotus 1-2-3, don't have print drivers, so users must hike over to the printer and physically reset it.

VPT now eliminates these chores. During network setup, the net manager programs the printer with up to 64 different configurations, called virtual printer settings, from a PC or workstation running Unix or VMS, or any network management console supporting SNMP. A variety of parameters can be selected for each virtual printer setting including protocol (Apple EtherTalk, Novell IPX, TCP/IP, and DEC LAT); file format (either PostScript or printer control language [PCL]); and resolution (300 by 300, 400 by 400, 600 by 600, or 800 by 800 dots per inch). Further, a user hierarchy can be created, prioritising user print jobs.

To allow users to pick the proper settings, during setup the net manager also assigns each of the 64 possible settings a different address, using the protocol address field in EtherTalk, IPX, TCP/IP and LAT packets. Users are notified of these addresses, and their associated virtual printer settings, via broadcast packets. Depending on which NOS users are running, this information appears either in icon or text format on their screens (VPT works with 19 network operating systems, including NetWare).

VPT is currently available on two of Dataproducts' laser printers: the LZR 1580, which handles 15 pages per minute (ppm), and the LZR 2080, which prints 20ppm. Both devices offer resolutions from 300 by 300 to 800 by 800 dpi, and can be attached to Ethernet LANs running over either UTP or coaxial copper cable.

Dataproducts plans to enhance VPT three ways in a planned fourth-quarter release. First, a new parameter will be added that will let network managers specify which of the printer's paper trays are available to each user. Second, VPT will be able to work with two additional NOSs: Microsoft LAN Manager and Windows NT. Third, net managers will be able to gather usage statistics, such as how many pages each PC has had printed.

The LZR 1580 costs $6,895, and the LZR 2080 is priced at $8,495.

Dataproducts (02) 451 3533

Auto-Routing Fax Software

Unixpac has released Xpress-Fax 2.0, which the company claims is the world's first fax

software to offer true auto-routing capabilities.

The software has been developed jointly by XpressWare and Andataco. It allows SPARC users to quickly and easily send, edit and receive faxes directly from their workstations. The Xerox ScanWorX (OCR) engine has been bundled with XpressFax 2.0, giving the software its automatic routing capability.

The package features a new user interface using the Open Look Interface Toolkit, which includes pull-down menus and on-line hypertext. The new version also has a faster editor and true floating licence capability.

The OCR engine is included as standard with the 5-user licence pack. The product costs $490 per user.

Unixpac (02) 953 8366

Printer Sharing

Sprinter Products has announced an addition to its Port Authority family of printer sharing devices, and upgraded versions of the existing models.

The units, which have undergone major design changes, offer flexible network-independent printer sharing options, allowing the connection of up to 16 computers and printers in any combination, according to a company spokesperson.

Each port on the Port Authority can be set for input or output, allowing users to link their machines in a customised setup that suits the way they work. The units have a slim profile and are very compact, so they can be attached to the side of a printer or mounted on a wall if space is a problem.

The newest addition to the product family is the entry-level PA 40, which has four parallel ports that can be configured for input or output via simple menu-driven software. It is priced at $472, ex tax.

The mid-range Port Authority PA 44 has four parallel ports and four RJ11 serial ports and sells for $792 ex tax, while the PA 48 model offers four parallel ports and eight RJ11 serial ports and costs $1,112.

The Port Authority units are small enough to attach to a printer

The top-of-the-range model, the PA 412, has four parallel ports and 12 RJ11 serial ports that allow for any combination of 16 computers and printers, and sells for $1,512 ex tax.

Sprinter (02) 977 8155

NetWare 4.0 for Mac

Novell has announced the release of NetWare for Macintosh 4.0. The software permits as many as 1,000 Macintosh users to log into a NetWare 4.0 server at the same time.

Among the new features included in version 4.0 are: access to NetWare Directory Services via Bindery emulation; DOS file extension mapping; HFS CD-ROM access; enhanced printer services; and optional AppleTalk routing.

NetWare for Macintosh 4.0 is available in either five-user or 1,000-user packs. It is priced at $2,200 for new customers, while NetWare for Macintosh 3.x customers can upgrade to version 4.0 1000-user for $785.

Novell (02) 413 3077

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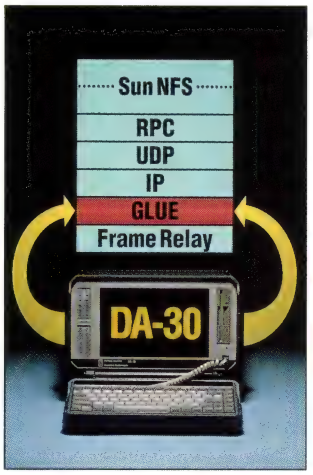


The 'Glue' package allows users to decode proprietary protocols

New DA-30 Protocol Packages

Wandel & Goltermann has announced a range of new software packages for its DA-30 Internetworking Analyzer.

The new Sun NFS protocol suite consists of decodes for Sun's Network File System protocol, which resides at Layer 7 of the ISO model, and the Remote Procedure Call (RPC) protocol, which resides at Layer 5. Both are based on Version 2 of the Sun NFS specification.

A new suite of ISO/GOSIP decodes adds decodes for the End System to Intermediate System Protocol at Layer 3 and Session Protocol at Layer 5.

Company officials said both suites provide protocol-specific trace summaries that display frames at the message level. Frames can be viewed in detail to examine fields in hexadecimal, binary or ASCII formats, and the packages also provide extensive post-capture filters and commands for searching for particular frame types such as errored frames.

The company has also announced two new Layer Protocol Packages (LPP). The 'Glue' Package effectively 'glues' protocol layers together, allowing users to perform rudimentary decodes on proprietary protocols or skip over them. The 'Glue' Package exploits the DA-30's 'custom stack' option by allowing users to load any protocol at any layer, enabling many of the most common encapsulations to be decoded directly, said officials.

The second LPP supports the Cisco proprietary SLE protocol at Layer 2. This protocol is responsible for transmitting routing information between any two networks, and when loaded on the stack the W&G Cisco SLE LPP decodes all SLE protocol data showing the direction of the traffic (between the DTE and DCE), the destination of a particular frame and information on the packet type contained in the frame (for example, IP, XNS, Novell IPX and so on).

The software also provides an indication of the higher layer protocol contained in the data field, as well as hexadecimal decodes describing the frame headers, and also supports Cisco's Serial Line Address Resolution Protocol.

The 'Glue' Package is an enhancement to the DA-30 core software, and the Cisco encapsulation decode comes bundled with the DA-30's WAN Data Link Layer Package.

Wandel & Goltermann
(03) 690 7600

Windows LAN-SNA Gateway

IDEA Technology has introduced the IDEAcomm Gateway 5250 for Windows, which provides Microsoft Windows users with simultaneous access to multiple IBM AS/400 and System 3X environments.

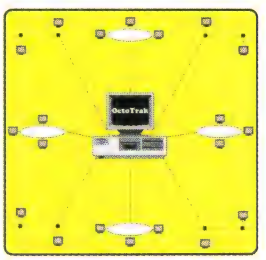
The gateway supports Novell's IPX/SPX protocols, and provides SDLC and X.25 communications at speeds of up to 64Kbps per host link.

Until now, company officials claim, users were required to close Windows before mid-range connectivity could begin. The IDEAcomm Gateway 5250 for Windows allows them to move easily between PC host applications, and transfer data

Your Corporate Network at Your Fingertips

Today's generation of LAN problem solvers finds it confusing that there are LAN analysers on the market which exhibit quite different standards for performance and reliability. For example, many are still based upon ordinary NIC cards. But with ever increasing traffic loads, this is like riding a bicycle on the Interstate. So Azure designed the LANPharoah for Token Ring and Ethernet and equipped each one with a RISC co-processor-based adaptor card with up to 16MB of on-board RAM.

The software is easy to install and operate. It works on nearly any PC with truly real-time applications ranging from statistics gathering to protocol decode. Precise error reporting, station leading and even response times are shown by the touch of a single key. Full 7-layer decodes for protocols such as NetWare, SNA, TCP/IP, SNMP, XNS, NetBEUI, DECnet, LAT, LASTPort, AppleTalk, Banyan VINES, SMB, OSI, X-Windows and others are provided.



The LANPharoah can solve your internetworking problems effectively since it allows a single PC to monitor up to eight networks concurrently in any combinations of Token Ring and Ethernet. The Duo Trak feature uses time synchronised split- screen displays to monitor and test both bridges and routers. The Distributed LANPharoah allows remote access for in-depth problem analysis and sends alarms to any or all network locations for immediate attention.

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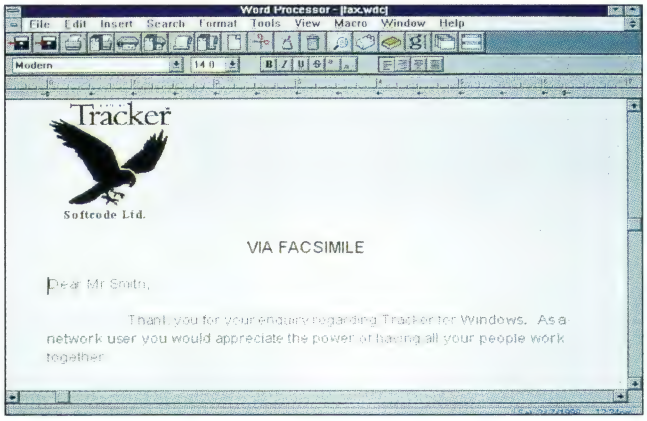

Tracker for Windows has built-in access to AT&T's EasyLink

with proper security clearance. Support for DDE means PC and host files can be linked and updated automatically, while the point-and-click IDEApad and Hotspots features activate user-defined PC or host functions.

Up to 128 concurrent PC users can be supported on a single server PC, which provides host connectivity to PC LAN users for terminal and printer emulation, file transfers and other applications. Up to four host links can be connected to a single server and multiple servers can be configured on each LAN.

The IDEAcomm Gateway 5250 for Windows consists of an adaptor card that lets the server PC accept multiple synchronous interfaces, plus client-based software for IBM 5250 terminal emulation and server-resident software to provide host communications support.

Pricing ranges from $5,610 for an 8-user licence to $15,750 for 128 users. Upgrade options are available for existing IDEAcomm Gateway users.

IDEA Technology
(02) 899 9900

Tracker For Windows

Softcode has announced the release of a Windows version of its Tracker contact management system software.

The new product offers the ability to pull up several databases on screen at the same time, or alternatively different records from the same database, enabling the easy cross-referencing of information.

The addressing capability has been upgraded to allow 255 characters in each of the 75 fields. Networking functionality has also been improved.

The Windows version of the product features its own electronic mail, which is able to interface with Microsoft Mail and other MAPI-compliant systems. It also has a transparent interface to AT&T's EasyLink Services, which gives users access to global messaging via proprietary e-mail and fax links.

Tracker's word processor allows users to prepare letters, notes and memos, and direct mail and direct response letters which can then be merged with the address base. It is also able to read data from most popular word processing packages including Microsoft Word, WordPerfect and WordStar.

Tracker for Windows requires Windows 3.1 or later, 2Mb of RAM and 5MB hard disk space. It sells for $699.

Softcode (03) 853 3288

EISA Interface Cards

Kingston Technology has released two 32-bit high performance EISA Ethernet network interface cards.

The new cards are additions to Kingston's EtheRX family of products, and use direct bus mastering to transfer data between

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the system and the network, which the company said eliminates expensive CPU and memory components from the card. They are based on the PLX EISA 9032 LAN controller chip, and are available in either a dual interface configuration that supports 10Base-2 and 10Base-T, or a three-in-one version that provides users with 10Base-2, 10Base-T and 10Base-5 connections. The cards are compatible with NetWare and NetWare Lite, Microsoft LAN Manager, Windows for Workgroups and other popular network operating systems, the company said.

The dual interface EtheRX EISA card will retail for $485, while the three-in-one EtheRX EISA card sells for $650.

Kingston Technology
(03) 690 9699

Token Ring Module

Toren Computer Communications has announced a new Token Ring access module from Lannet that has ten intelligent active ports which perform retiming and full signal regeneration, supporting longer distances and preventing beaconing.

The LTR-104A module combines flexibility, manageability and fault tolerance, according to officials, and each port is capable of accommodating either UTP or STP cabling.

Over UTP, the LTR-104A supports lobe distances exceeding 180 metres, and up to 132 stations can be supported over a single network. A single STP network can support up to 260 stations.

A special error detection feature prevents beaconing caused by the insertion of workstations operating at the wrong speed into the ring. The LTR-104A can connect to Token Ring workstations and to other MultiNet hubs or Token Ring MAUs, or alternatively can operate independently as a standalone 10-port MAU, said officials. Lobe ports can be configured as Ring In and Ring Out, and the module can be connected to one of two Token Ring segments in the MultiNet II enclosure. Multiple independent rings can co-exist within the same network hub, which can reduce congestion.

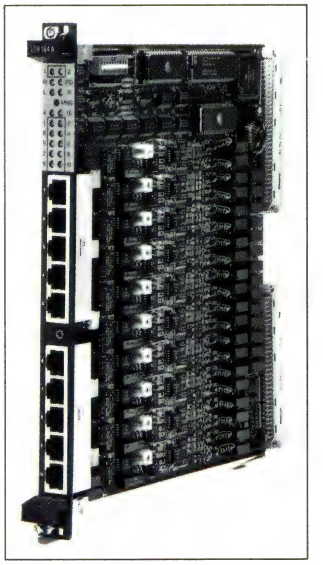
The module operates at 4 or 16Mbps, and up to 18 modules can co-exist in the hub, providing connections for up to 180 lobes. The fault-tolerant module detects cable breaks on lobe and inter-hub links, and performs automatic loopback. It is manageable using Lannet's MultiMan network management system.

Toren (03) 242 5000

Retix High End Router

Retix has announced Release 2.1 of the RouterXchange 7000 (RX 7000) multiprotocol router.

The new release offers new features including support for interoperability standards such as Point-to-Point (PPP), Open Shortest Path First (OSPF) and RFC 877 for X.25, which collectively allow the RX 7000 to interoperate with other routers across the local and wide area network, officials said.



The LTR-104A supports lobe distances of up to 180m over UTP

In addition to these new interoperability features, Release 2.1 also includes Service Advertisement Protocol (SAP) Timers, which limit the bandwidth

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FE

Alfatron's A2000 and A2100 can connect up to eight PCs and printers

congestion which can often be created by SAP broadcasts in an IPX environment.

Company officials said Retix will provide upgrades free of charge for existing users of RouterXchange 7000 units.

Retix (03) 563 4333

Printer Sharing Devices

Melbourne-based Alfatron recently released its new Australian designed and manufactured A-Series A2000 and A2100 printer sharing devices (PSD).

The devices can connect up to eight PCs and printers in any combination, with a throughput of 42,000 characters per second. Both feature industry-standard interfaces and easy to use Setup and Control software for both the Windows and DOS environments, said Alfatron officials.

Other features include bi-directional parallel ports; use of SIMM memory for buffering up to 4MB; five different types of handshaking, including Robust Xon/ Xoff; RS-422 support; and string handling capability.

Alfatron (03) 720 5411

UB Segmentable Stackable Hub

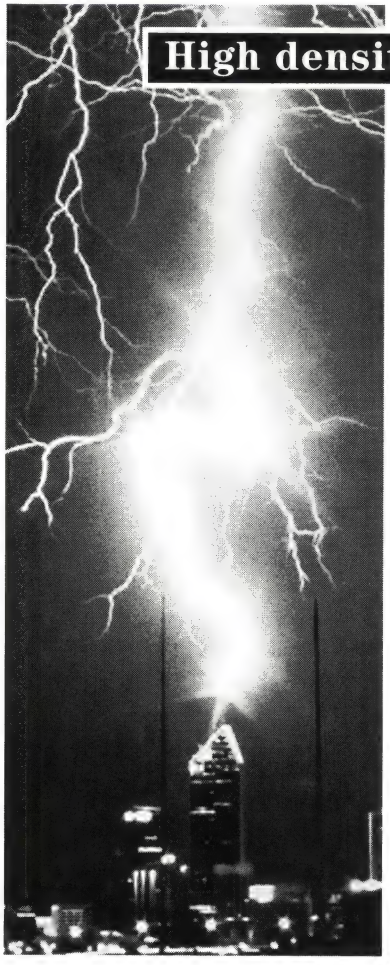
Ungermann Bass has released Access/Stax, a new stackable 10Base-T hub which offers software-assignable segmentation.

The product will form part of the company's Access/One line of enterprise connectivity products, and will come in both managed and unmanaged versions.

Three separate network segments can be supported within each Access/Stax. Each hub provides 24 RJ-45 ports, which can be divided into three 8-port segments. Segmentation and port partitioning are made simple via a push button interface on the unit's front panel, officials said. Additionally, one port can be configured to support Thicknet, Thinnet or fibre interfaces.

Access/Stax allows up to five hubs to be placed in a single stack, so the system can support up to 120 ports with up to 15 segments, providing a total bandwidth of up to 150Mbps. In addition, only a single managed Access/Stax is required to manage the entire stack, which results in a significant cost saving, according to officials.

The hub offers full Simple Network Management Protocol (SNMP) with full MIB II support. Statistics are fully IEEE 802.3K compliant, which allows Ungermann-Bass' NetDirector management platform together with other SNMP-based



High density transient protection for telephone MDF

Lightning impulses can have currents exceeding 150,000 Amperes. It is this energy, together with the sharp voltage wavefront of the impulse, which gives rise to equipment damage and possible injury or loss of life.
This potential problem can be eliminated with inexpensive add-on components.

Critec Subscriber Line Protection

As the modern PABX is highly sensitive to transient voltage disturbances the traditional gas-filled arresters by themselves are no longer sufficient protection for telephone circuits. Critec has designed the SLP, Subscriber Line Protector for the telephone line, and the PLF, Powerline Filter for the mains supply. Together these two devices form an integrated protection scheme for any PABX, office system or switching centre.

Surge Reduction Filters

The SafeLine range of panel mounted Surge Reduction Filters from Critec incorporates high energy clamping with efficient low pass filtering. SafeLine SRFs are available in single or three phase configurations for load currents of 10A and 16A per phase and are installed in series with the circuit, usually at the local distribution board.
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CRC-A274 OZ

management software to manage and monitor the stack. Support is also provided for Novell's Hub Management Interface, Hub Services Manager and HubCon management utility.

In addition, U-B will provide integration of the new hub into its Virtual Network Architecture, officials said.

Ungermann-Bass
(02) 925 4000

NetWare 4.01

Novell has announced the release of NetWare 4.01, which the company said significantly enhances its existing 4.x range of products.

The new version includes enhancements to NetWare Directory Services (NDS), and each NetWare 4.01 CD now includes NetWare in five languages — French, Italian, German, Spanish and English — making it easier for companies to use NetWare in their offices worldwide. Other new features include graphical utilities for OS/2 Presentation Manager, a five-user stratification of NetWare for Macintosh, and updated versions of the Virtual Loadable Modules for DOS and Windows clients.

Enhancements to NDS include greater scalability, faster synchronisation, self-repairing capabilities and better internetworking support, officials said.

NetWare 4.01 is available free of charge to all registered NetWare 4.0 customers. For new customers, the product is available in various user-configurations, and pricing is the same as for NetWare 4.0.

Novell (02) 413 3077

New Pocket Modem

Mike Boorne Electronics has released the company's new Spirit Pocket modem.

The unit is small enough to fit in the palm of the hand, and is battery-powered with a built-in 'sleep' function to prolong battery life, even when the power is left on, according to a company spokesperson.

The Spirit Pocket is Austel-approved, and can operate at V.32*bis*, V.22*bis*, V.22 and Bell 212A. It can handle a range of speeds including 14,400, 12,000, 9600, 7200, 4800, 2400, 1200 and 300bps.

It has a data compression facility (V.42*bis* and MNP Class 5), and offers full-duplex dial-up and fax standard Class 2, Group 3 send and receive capabilities. It comes with QuickLink II communications software, and is priced at $749.

Mike Boorne Electronics
(02) 416 9168

High Speed Print Servers

MPA has introduced the new NETSprint range of high speed external hardware print servers for Ethernet and Token Ring networks from Digital Products.

The initial product release comprises two models that support the Novell environment. The NETSprint/100 for Ethernet or for Token Ring enables two printers (two parallel, or a parallel and a serial) to connect directly to a Novell network without the need for a PC or for special software such as a VAP or NLM.

Company officials claim the NETSprint is the fastest print server on the market, with maximum parallel throughput of up to 200,000bps, enabling the unit to deliver data from the print queue at a speed comparable to today's fastest printers.

The unit includes two printer ports, a high-speed parallel and a Uniport which can be configured as serial or parallel. The Ethernet version comes with connectors for both 10Base-T and Thinnet, and the Token Ring version has DB9 and RJ45 connectors for 4/16Mbps Token Ring cabling. A single NETSprint supports up to 32 queues on eight file servers.

MPA International
(03) 724 4444

The PC-based WAN protocol analyser family from Network General

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Put the power of a dedicated 72Kbps analyser into a personal computer.
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LM1 PocketScope
Zero slot -The first PC-based protocol analyser for WAN testing that does not require an expansion slot. Ideal for portable or on-site desktop PCs.
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- Level 2 statistics
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Network General

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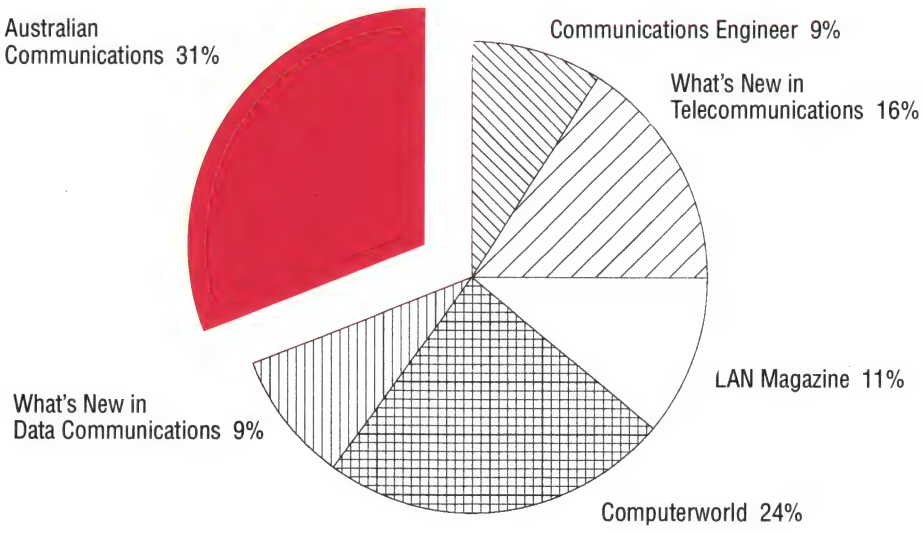
Telephone: (02) 630 7528 Fax: (02) 630 7226

Which publication is read by more communications professionals?

ATUG - The Exhibition and Conference of the Australian Telecommunications Users Group is unquestionably the major communications event in Australia. Visitors to the annual event are widely considered to be the region's top communications professionals, responsible for the lion's share of its networking and telecommunications purchasing.

Upon registering at ATUG'93 visitors were requested to indicate the communications/networking publications they regularly read. Judging from the **4,690*** completed questionnaires *Australian Communications* is clearly the choice of communications professionals

" I regularly read...."



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Pacific Telecommunications Council

Tourism and Telecoms — The Unseen Opportunity?

Every so often, one reads in the papers about the importance of tourism to the national economy, or how tourism has become one of the most important service industries. In the trade press, most telecoms people have come across articles citing tourism as the 'single largest user group of telecommunications,' which is quite true. Why, then, is there such a gulf between telecoms professionals and the tourism industry?

Tourism is a communications industry: from computerised reservation systems (CRSs), to on-line travel databases, to new applications that, regulatory red tape permitting, will permit you to make best-price travel bookings and receive tickets over your own PC. Think about how telecoms are involved in every step of the travel process. Indeed, think about the role of telecoms in your last business trip. Travel and telecommunications are ultimately intertwined, if largely unaware of one another.

PTC has, over the years, endeavoured to bridge this gap and bring these two interdependent groups together. We have joined forces with the Pacific Asia Travel Association and Tourism Canada and are organising a three-day conference entitled 'Information Technology for Tourism: A Tool for Profit.' The conference will be held on 22-25 February 1994 in Vancouver, British Columbia, Canada. Sessions focus on tourism applications for new media, where new telecoms technologies may be applied in the tourism field, underserved market niches, how databases can be marketed, how public networks serve as tourism conduits, destination management systems, the flourishing of EDI in the travel industry, and future expansion.

As George Darby, a Hawaii-based technology lawyer, has stated, "the travel industry is at the forefront of business information technology. . . " And the travel industry is undergoing a revolution as new interactive multimedia applications are being applied to it. The opportunities are particularly strong for small and medium sized telecoms and information technology equipment manufacturers, software and service providers, and affiliated telecoms entities. This is largely the result of the multiplicity of travel/tourism industry providers, from the smallest corner-shop travel agency to multinational airline, car rental agencies, and hotel chains. Without being completely aware of the fact, the larger travel industry stalwarts are at the cutting edge of information technology applications.

"Tourism institutionally should seek opportunities to influence the use or application of new technology and, where possible, assist in the development of global standards for their technology."

PTC has been tracking these developments for some time. In preparation for the forthcoming February 1994 Vancouver meeting, we are alerting PTC members and non-members alike to the importance of the tourism-telecoms inter-relationship. This is not a new subject for PTC. In 1991, telecommunications and the travel industry comprised the central theme of our major mid-year seminar. From the pleasant setting of Bali, Indonesia, about 150 telecoms and tourism professionals met to discuss everything from the role of telecoms in promoting sustainable growth, to assessing the pitfalls and promises of telecoms and tourism as catalysts of national development, to looking at specific telecoms applications and markets in the tourism industry in Indonesia, Taiwan, France, Canada, Australia, and other countries. Copies of the Proceedings of that landmark meeting are available from the PTC office.

The Bali PTC meeting illustrated the diversity of viewpoints on this topic. Tourism can be a fragile underpinning for an economy, as it (to paraphrase Tennessee Williams) always relies on the goodwill of others. More to the point, tourism relies on high disposable incomes (and is highly vulnerable to recession), stable currencies, and stable political situations. Tourism centres may also be vulnerable to the whims of taste — as is obvious to anyone who has ever seen the faded glories of Brighton, Ostend, or Atlantic City. Behind the palm trees and tour buses, it is a very complicated industry and, it should be noted, a serious enterprise involving high stakes.

Nowhere are these stakes higher than in the multi-billion dollar telecoms and information technology infrastructure projects undertaken within the travel and tourism industry. One can see from the business pages that much of the wrangling over airline mergers, bankruptcies, or takeovers centres on the fates of the all-powerful and all-profitable computerised reservation systems (CRSs).

Yet, as noted above, the telecoms industry and the travel/tourism industry could do much more to communicate and work with one another. Ian Kennedy, of the Pacific Asia Travel Association's Pacific Division, outlined some possible avenues for collaboration at the PTC Bali meeting.

The travel industry generally should more fully understand the technological development in the telecoms pipeline as well as the impacts on their industry and also potential users of this technology by their industry. He argued that tourism institutionally should seek opportunities to influence the use or application of new technology and, where possible, assist in the development of global standards for their technology.

At a practical level, the travel industry will have an increasing need for information of a socio-cultural (or demographic) type on consumer trends and marketplace information. Institutionally, as well, the tourism industry should ideally work with its telecommunications counterpart on that technology which will have the effect of changing lifestyles and work habits in order to optimise the compatibility of the industries with such changes.

The travel industry generally should advance techniques for the provision of information at all levels of its industry.

While these points are not as clear as they might be, their lack of clarity is itself illustrative of some of the lack of focus in the telecoms-travel industry dialogue. But that is not to under-emphasise the importance of Mr Kennedy's words. It's vital that the travel industry recognise the importance of telecoms to its health — indeed, it is so fundamental, it is taken for granted.

For its part, the telecoms industry could profit hugely from a more serious view of the travel industry. Both products and services could be better tailored to this market, and an increased dialogue would undoubtedly be a lucrative venture for telecoms entities innovative enough and courageous enough to take advantage of the opportunities. We look forward to seeing these telecom innovators in Vancouver next February! (For more information, contact the PTC office in Hawaii at +1 808 941 3789 or fax +1 808 944 4874).

James Savage is the Assistant Director, Pacific Telecommunications Council and the Editor of the Pacific Telecommunications Review.

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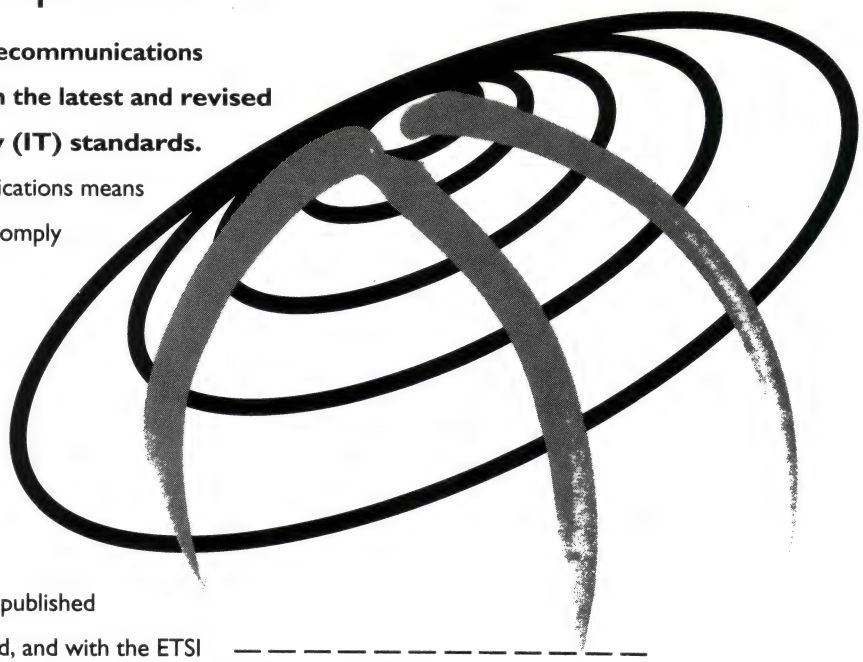

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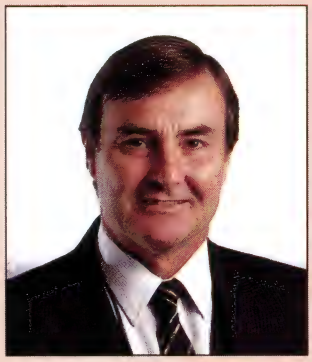


From the desk of the Executive Director

New Service Levels — A Baseline for Competition

Wally Rothwell

Telecom recently filed a tariff with Austel (filing 102), providing 'Standard Levels of Service' for most of its voice and data business products. The filing was approved in early August and is now in operation.

ATUG's reaction to this filing is generally favourable, mainly because the standard hours of service have been extended significantly and because response and restoration times have been reduced to a more acceptable level. While we're concerned that Megalink service is not being accorded the attention it deserves, the new levels provide a substantial improvement over the previously ambiguous terms of service.

ATUG members will remember the serious opposition we mounted to what were called 'Service Assurance Levels' introduced by Telecom in late 1991. We claimed that this represented an increase by stealth in business service costs, even though they were price capped. As a result, Austel, in one of its first 'directions' to Telecom, insisted that the charges be withdrawn and refunds paid where appropriate.

Now we have a new set of much improved service standards, setting a baseline from which competitive service can evolve.

The new Standard Levels of Service are highlighted by five aspects over what had come to be regarded as service levels previously offered (see table). These are:

- Higher grade managed services continue to receive 24 hour 7 days a week service;
- The levels of service are reduced from 6 to 4 [Business, Business Plus, Premium and Express];
- Improved standard coverage, for all services, from 7am to 9pm;
- Response time for Business Plus and Premium level halved to two hours and restoration time reduced from 18 to 12 hours; and
- So far as we can tell, no product suffers from a reduction in service.

Megalink service has been left in the Business Plus level, and therefore does not receive 24 hour service. We believe that Megalinks are so important to users of the service that they should receive all-hours support.

OLD AND NEW SERVICE LEVELS COMPARED

	Previous Levels						Filing 102 - Standard Levels of Service			
	Basic	Bus4	Trad	Bus+	Prem	Exp	Business	Business Plus	Premium	Express
DDS with Vitalink						24 hour 7 days 1/6	←			**24 hour 7 days 1/6**
Austpac X.25 Macrolink etc.					24 hour 7 days 2/12		←		**24 hour 7 days 2/12**	
Microlink Megalink etc.				8-9 M-S 2/12 PH	←			**7-9 M-Sat 2/12 PH**		
Low Speed Data		8-5 M-F 4/18 No PH	7-6 M-F 2/12 PH	←						
Non-Mgd Services PSTN Access	8-5 M-F 8/18 No PH	←					**7-9 M-Sat 8/18 PH**			

PH = Public Holidays

Having represented this view to Telecom, they tell us that the service is not fully managed, as it is served in some instances by unmanned exchanges. Our comment has been 'Fair enough. How about providing Premium service where Megalink can be managed and Business Plus where it can't?' Telecom has offered to look at the possibility of perhaps segmenting the service, depending on geographic location (CBD, metro, country, inter-capital).

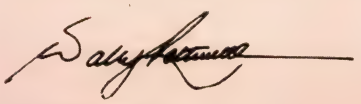
For a price, user organisations can obtain a higher level of service for different products. To lift data products into Premium level will cost $750 per service for point-to-point or $375 per end, per annum. For voice, the equivalent charges are $500 and $250. And to go from Business to Business Plus for data and voice, the fees are $350 and $175.

Where a service is not covered by 24-hour service, an out-of-hours call out fee of $350 is charged. Many ATUG members have complained that the rules seem to be applied unevenly and are not clear.

ATUG has taken the issue up with Telecom, which has agreed to consider alternatives to the $350 fee if the correction is done without a Telecom technical officer being called out or is completed from a keyboard. Telecom will also look at alternative means by which authorisation for payment of the charge can be obtained.

In general, we think that the new system is certainly a step in the right direction and, except for the Megalink service level, have not opposed the filing of this tariff.

Importantly, we now have that baseline for standard levels of service, which Telecom's growing list of competitors will have to better if they want our custom.



Wally Rothwell
Executive Director

Network Management Issues Canvassed by ATUG

Communications managers of member organisations had received a questionnaire for ATUG's survey into network management issues earlier this year. Some of the aims of the survey included the identification of the significant components of users' networks; the most popular network management systems; the network management techniques used; and the network architectures used.

Many members are eagerly awaiting the results of the major survey on network management issues conducted recently on behalf of ATUG. Indeed, we are grateful to the many members who provided an input to the process as sponsors, respondents or the provision of supplier input. The report is now available for purchase.
The complete report, including quantitative data runs to over 40 pages, together with well over 60 pages of supporting information and suppliers' responses. The report is available at a cost, including postage and handling, of: $125 to ATUG members; and $200 to non-members
For copies of either the complete report or a copy of the Executive Summary, please complete the form below.

The survey was inspired by ATUG's Special Interest Group on Network Management and Integration based in Melbourne with the aim to study network management issues from the communications manager's point of view. As a result, ATUG commissioned Melbourne-based Strategic Technology Management Pty Ltd to conduct the survey.

The Results

The results of the ATUG Network Management Study indicate that:

- There is a substantial trend to virtual private networks (VPN) for the provision of voice communications services within large organisations. This will have a significant impact on whether voice and data networks are integrated, or are kept separate, and on the management of the networks. Many communications managers will, as a result, be seeking appropriate functionality from network management systems to help them manage VPN services;
- There is also a move away from host computer systems with directly connected terminals towards LAN and WAN structures, usually retaining host-based systems as applications servers. Most of the growth in networks is seen as coming from this LAN/WAN area;
- The tools available in network management systems are mostly for the operational or technical management of networks. Management of the services provided to end users is more often than not performed with the aid of computer tools or manually, rather than with the aid of tools that are an integral part of management systems. Likewise, net management system tools offer little assistance in managing the business aspects of operating a communications network;
- Networks are at present managed on a piecemeal basis, with different tools being used for each type of subnetwork. However a key requirement of most communications managers is to be able to manage their networks through an integrated platform;

ATUG Network Management Survey

Please forward _____ (qty) copies of the ATUG Network Management Survey at $125 for each copy ($200 non-members) for which I enclose payment of: $_____

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- Voice networks are managed on a node-by-node basis, without the facility to obtain an integrated overview of the state of the network. Data network management systems lack the ability to charge network users on a usage basis, which many communications managers would like to do;
- Most communications managers regard their network management system tools as barely adequate for the tasks they have to perform. This indicates the existence of a market opportunity for suppliers who can provide network management systems which more closely meet the requirements of all their customers;
- Use of service level agreements, with communications managers required to report regularly against them, is becoming common in large Australian organisations; and
- Most of the firms surveyed are likely to spend around $50,000 to $100,000 per annum on network management systems hardware and software over the next few years. According to some vendors, this might not be sufficient for them to obtain substantial improvement in the way they manage their networks.

Special Thanks to . . .

ATUG thanks all participants and sponsors for their support on this project. Specifically, ATUG thanks Digital and Telecom Australia for their contribution to this study as well as BHP, Ericsson, Gas and Fuel Corporation of Victoria, JNA Network Services, NEC, Siemens, Shell Australia and Trans-Mit.

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TITAB to Develop an Industry Training Plan

The demise of the Information Industries Education and Training Foundation last year left a vacuum in the skills requirements for the information technology industry.

In the past, the government monopolies, Telecom and OTC, were the principal sources of trained telecommunications engineers and technicians. To a lesser extent, the defence forces also contributed to Australia's telecommunications skills base.

ATUG's growing concern about the need for industry training led it to publishing a handy reference guide on the courses available in Australia which were suitable for the telecommunications industry. More recently, ATUG has been working with Telecom, Optus and the Communications Workers Union to construct advisory and policy formulation mechanisms for training and education within the telecommunications industry.

Earlier this year, ATUG members were informed of the pending formation of the Telecommunications Industry Training Advisory Board (TITAB) which would address pressing education and training issues that were specific to the new competitive communications industry.

Last month saw the formal launch of TITAB following support from the Department of Education, Employment and Training (DEET). Appointed to the Board are ATUG director, Brigadier Neil Horn, Communications Workers' Union national president, Alf Forster, Optus' general manager for human resources, George Webster, Telstra's director of personnel, Bruce McKay and Audrey Wilson from DEET.

ATUG's executive director, Wally Rothwell, acts as the alternate director to Brig. Neil Horn on TITAB while Melbourne-based manager for the Australian Electronics Development Centre Ltd, Chris Cartwright, takes over from ATUG's national business manager, Owen Richards, as the ATUG representative on the TITAB Advisory Committee. Telecom's former national business manager for network services with Telecom's Training Services, Leo Van Neuren, has been appointed as the TITAB executive officer. He said TITAB was set up to offer the industry an effective labour force by creating competency standards, national standard curriculum and by linking industry more closely with education providers.

"Work has already commenced on developing an industry map which identifies functions, occupational groups and employers that make up the industry," Van Neuren said.

Another function of TITAB is to help the Government's agenda of making Australia the 'clever country.' With this in mind, the Government will be funding TITAB to the tune of $150,000 and will also provide project funding. It also aims to develop national strategies for training and entry into the industry commitment with the training reform agenda.

TITAB will also study the labour supply and demand requirements of the industry. "Further, we will look at the best means of delivering the training, that is, we will look at communications technologies to encourage open learning environments," Van Neuren said.

INTERCEPTION & RECORDING?

Want to find out more about call interception and recording? Or any other topic in the Telecommunications Broadcasting or Radiocommunications legislation? Then you need the EIS Electronic Law Book on disk. The new EIS Electronic Law Book has been released and now includes all the updates to the Telecommunications legislation along with Broadcasting and Radiocommunications legislation.

The publication, on a floppy disk, is available to ATUG members at the special price of $150 including postage and packaging — a saving of $50. A subscription including a further two updates is also available to ATUG members for the special price of $295 — a saving of $100.

To ensure that you have the legislation at your finger tips at all times, take advantage of this special offer. Contact the ATUG secretariat for details of how to order. Telephone (02) 957 1333.

ATUG in the Hunter Valley

The need for local dissemination of information pertinent to regions has prompted a group of users in the Hunter Valley region of New South Wales to get together to form the ATUG Hunter Valley branch.

The group held its inaugural meeting in April this year where Rodney Gray was appointed Branch Secretary and John Croxson was appointed Deputy Secretary. Some of the larger members to attend meetings include BHP, Coal & Allied, Hunter Area Health Services, the RAAF, Shortland Electricity, Hunter Technology, Telecom Australia, the University of Newcastle and Wyong Council.

According to Gray, many of the developments in telecommunications are taking place in the capital cities while regional areas miss out. "The Hunter Valley is the sixth largest metropolitan region in Australia after Perth and Adelaide — yet we are often neglected," he said.

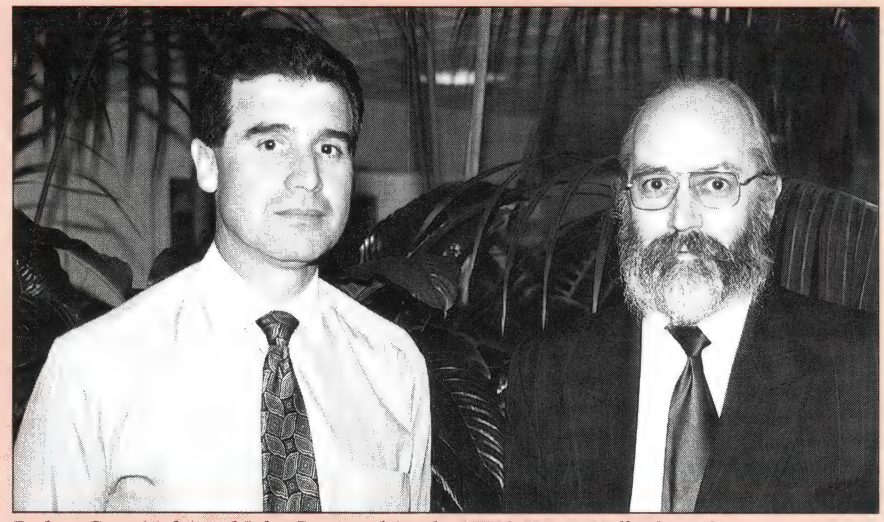
By establishing a branch locally, ATUG members in the region will be able to discuss problems with the carriers on-site. One example of a local problem is the poor ISDN service offered in Newcastle which is causing some alarm among users needing to transmit voluminous data. "This is because the service is provided by the North Sydney exchange so that local calls go via Sydney to Newcastle — for data this is not good enough," Gray said.

Telecom's area sales manager, Ian Stevenson, said he was pleased to be involved with the new branch. "We have a good relationship with users," he said. Recently, Stevenson was alerted to a problem of incorrect measuring of test lines by the new ATUG branch and had it rectified.

The branch is currently looking at the issue of cabling and the need for proper training and regulation in this area.

So far, some of the topics presented during branch meetings have included services from Optus and AAPT, Austel's role, BT (Australasia) and its involvement with the New South Wales Government Telecommunications Network. Meetings are held on the fourth Thursday of each month at the Hunter Technology Centre, University Drive, Newcastle (adjacent to Newcastle University), commencing at 4:00pm.

Members who wish to know more about the ATUG Hunter Valley Branch should not hesitate to make contact with Rodney Gray on (065) 711 124.



Rodney Gray (right) and John Croxson drive the ATUG Hunter Valley branch

Roy Morgan Research Surveys ATUG Members

ATUG's mission is to represent the interests of Australia's telecommunications users in facilitating the availability of a wide range of reliable, high quality services and products at competitive prices.

In addition, it aims to provide service, assistance, advice, personal networking and information to members in order to optimise their communications capabilities and costs.

ATUG also acts as the users' voice with the government, the industry regulator and the carriers, to ensure that the new competitive environment operates effectively.

With this in mind, ATUG has commissioned a survey to be conducted by The Roy Morgan Research Centre Pty Ltd so that members may have their say as to how well ATUG is achieving its mission. A similar survey was conducted in 1991.

In August this year, a pilot report based on the Focus Group technique where participants are allowed to respond to topics in their own terms, interact with other respondents and shape the discussion with their responses, found that overall "ATUG was a well-run professional body offering a range of useful products and services to its members."

Project Director for the Roy Morgan Research Centre survey, Angela Bateman, will be responsible for conducting the national survey.

ATUG IN SOUTH AUSTRALIA

ATUG members in South Australia should take advantage of the guest speaker presentations organised on a monthly basis by the South Australian Committee. The meetings are held on the third Friday of each month from 4:30pm to 6:00pm. For further information, contact ATUG State Secretary, Peter Hamilton, on (08) 344 6743.

The Broadbandwagon

'Broadbandwagon' was a term first used in 1989 to refer to the questionable predictions about the supposed explosive growth in residential bandwidth. Today, there is as much debate on the subjects of:

1. The rate of growth of corporate networks;
2. The increase in meshed traffic patterns rather than terminal-host;
3. The integration of all types of data networks (leased, circuit-switched, packet switched, cell-switched); and
4. The integration of data, voice and video networks.

Let's just consider the bandwidth growth issue now. There is little doubt that as networks are replaced or upgraded, greater bandwidth will be needed, but will there be an explosive quantum leap in bandwidth needs? Obviously this will occur only if there is similar growth in the number of users/applications, or if the bandwidth requirements of each application increase dramatically.

The number of applications and users is increasing. PCs proliferate and applications are demanding greater network capacity, whether due to the popularity of e-mail or the commonplace habit of attaching large Windows files to e-mail.

Client-server structures are also becoming the norm, however multimedia is not yet being implemented to any significant degree as hardware prices have only just dropped to levels where they can be justified beyond the specialist. Videoconferencing from the desktop is still so expensive that it may still be many years before it becomes a measurable percentage of corporate traffic.

Countering the growth in bandwidth is the popularity of data compression due to its low cost and standardisation. Compression is now common-place as an integral part of modems, routers and video cards.

Just how much bandwidth are future networks likely to use? If we assume that a 500% increase is adequate to allow for network growth and new applications, then the following picture emerges:

Interestingly these are just the speeds where frame relay switches and networks will operate. Through multiplexing on the access line, frame relay also provides the connectivity needed for meshed networks. Frame relay is a simple, low-level protocol, which allows it to be used to transport many higher-level protocols for routing, SNA networking, etc. However, delay-sensitive services such as voice and video are not really suited for transport over a frame relay network which is already being effectively loaded up with data traffic.

Frame relay is consistent with three of the four corporate network trends. This must be highly regarded as the only solution, consistent with all four trends, as Broadband ISDN is not going to be widely available in a standardised form for three years.

COMPARING BANDWIDTH REQUIREMENTS

	Typical bandwidth today	New Networks
Most existing networks	9.6K	64.0K
Existing High speed links	48.0K	256.0K
Existing wideband links	256.0K	1024.0K

ATUG in Queensland

ATUG has played a prominent and significant role within the telecommunications industry, and this year has been no different.

Following the introduction of Optus, ATUG has continuously monitored the competitive situation and maintained its input to the implementation of the new communications arrangements. It has continued to advise and assist its members to make the right choices to benefit from the competition between service providers for telecommunications services.

With this in mind, ATUG was proud to present a debate on the preselection ballot in Brisbane in August this year. The debate was held as a breakfast function and it attracted around 300 delegates. ATUG was also proud to conduct the third annual seminar and exhibition on telecommunications in Queensland — dubbed 'Competition, Choice and Confusion' — held in Brisbane on Thursday, September 2nd, 1993.

The occasion was used by Optus Communications to make a major announcement and it offered users in Queensland the opportunity to view and evaluate the latest in technological developments within the telecommunications industry. Further, it assisted users in coming to grips with the issues that will face them as the decade introduces new means of communications.

Highlights included a case study presented by the Brisbane City Council's director of communications services, Frank Vardanega, on how the Council benefited from the deregulated market; a look at remote telecommunications such as teleconferencing for distance learning; the use of mobile communications; security and the preselection ballot.

Speakers included ATUG's executive director, Wally Rothwell, Austel's Johanna Plante, Amos Aked Swift's Tom Amos, Q-Net's managing director, Rick Strangman, Telecom's national manager for Talkabout, Albert Sommer and Queensland University of Technology's William Caelli. This one-day event was held at the Hilton Hotel.

1993 INTERDATA HANDBOOK NOW AVAILABLE!

ATUG has sponsored the third edition of the Interdata Telecommunications Handbook, published by IDP Interdata Pty Ltd. This easy reference guide to the telecommunications industry is offered to ATUG members at the discount price of $50, which includes postage and handling. To order, telephone ATUG on (02) 957 1333 or fax your order to (02) 925 0880.

October

12-13 **Philippine Telecommunications Development Summit**, Shangri-La Hotel, Manila. Recent government policy changes in the Philippines will mean expanded opportunities for foreign companies. This conference looks at the impact of the changing regulatory environment, tariff and pricing issues, the legal requirements of doing business in the Philippines, current and future trends in Philippine telecommunications, and the expansion plans of operators and service providers. Fee: $US895. Enquiries — AIC Conferences Tel: +65 222 8550 Fax: +65 226 3264.

12-14 **The Inmarsat International Conference and Exhibition on Mobile Satellite Communications**, CNIT, Paris. The first Inmarsat conference and exhibition in 1989 focused on the development of mobile communications. This year the conference will be addressing the future of mobile satellite communications, and senior-level speakers will present their views on a range of issues covering all aspects of the industry. The format will consist of plenary and streamed sessions, and there will also be a series of open forums. The exhibition will show the latest equipment in the field of mobile satellite communications. Enquiries — Tania Starley, IBC Technical Services Tel: +44 71 637 4383 Fax: +44 71 631 3214.

20-22 **PABX Value Added Voice Systems**, Hotel Nikko, Potts Point, Sydney. This event, which includes a one-day workshop covers a wide range of topics in the voice communications field, including: developments in infrastructure and tariffs by Telecom and Optus; Austel standards; PABX networking; software applications; chargeback strategies; PABX and multimedia; voice compression techniques; voice and data integration; public/private network planning, and more. The workshop will focus on the technical, organisational and economic issues involved in integrating voice and data. Fee: two-day conference $1,295; conference and workshop $1,795; workshop only $795. Enquiries — AIC Conferences Tel: (02) 210 5700 Fax: (02)223 8216.

22 **Health Communication Network: Preparing for the 21st Century**, Sheraton Towers Southgate, Melbourne. This conference will provide an overview of the proposed Health Communication Network, and outline its anticipated productivity improvements for the health care sector, with information able to be distributed wherever and whenever it is needed. Enquiries — Elaine Wightman, CIRCIT Tel: (03) 616 8808 Fax: (03) 616 8800.

23-24 **Cable and Satellite Broadcasting** Sheraton Towers, Singapore. With the launch of three new satellites in the Asian region — Thaicom, AsiaSat 2 and Apstar 1 — the satellite industry in Asia is poised for dramatic growth. This conference will look at a wide range of related issues, including new technological advancements such as digital compression and future developments like interactive TV, regional regulation, the growth of marine satellite communications, business strategies and venture capital developments in Pay TV, and special country presentations from Malaysia, Hong Kong, Thailand and Singapore. Fee: $S1,395. Enquiries — IBC Technical Services +65 732 1970 Fax: +65 733 5087.

24-27 **The IREE Communications Conference**, Hilton International Hotel, Melbourne. The IREE has announced this new conference, which will replace the former IREECON. This year's inaugural event will have the theme 'Communications: Foundations for the Future,' and will run streams on radiocommunications, telecommunications and industry support. The keynote speaker will be the newly elected Director of the ITU Telecommunications Development Bureau, Mr Arnold Djiwatampu. A highlight of the three day event will be a special 'Hypothetical' session featuring a panel of key industry figures. There will also be a trade exhibition of the latest technology and equipment. Enquiries — Tel: (02) 327 4822 Fax: (02) 362 3229.

25-28 **Broadcasting Cable and Satellite India '93**, Pragati Maidan, New Delhi. This event covers radio and TV broadcasting, satellite and cable distribution systems, sound, film and video and related services. It will look at new opportunities in India resulting from new strategies by the government designed to attract investment. A trade exhibition will accompany the conference programme. Enquiries — Conference: Broadcast Engineering Society (India) Tel: +91 11 371 9978 Fax: +91 11 331 6674; Exhibition: Exhibitions India Tel: +91 11 462 2710 Fax: +91 11 463 3506.

25-26 **ATA '93**, Hotel Intercontinental, Sydney. This two-day event is entitled 'Complete Communications — Convergence in Action,' and features key local and international speakers, who will discuss a range of issues including telecommuting and the Global Village, teleconferencing, multimedia, regional trends in communications and interactive media. Fee: $1,295. Enquiries — AIC Conferences (02) 235 1700 Fax: (02) 223 8216.

26-27 **Telecommunication Development in the Western Pacific**, Guam Hilton, Guam. The Pacific Telecommunications Council's October Seminar will cover a broad range of issues relevant to telecommunications in the Asia-Pacific region, including regulatory issues, applications of telecom technology, technical developments in switching, fibre optics, plant management and transmission, and the use of satellite services to meet regional needs. Fee: Members $US50, non-members $US100, students $US25. Enquiries — PTC Tel: +1 808 941 3789 Fax: +1 808 944 4874.

November

1-4 **Token Ring Networks, and Troubleshooting Token Ring Networks**, IIT Training, Sydney. These two courses are designed to give attendees an in-depth view of Token Ring networking and associated standards. The Token Ring Networks course involves designing, building and implementing a network in a live environment, while the Troubleshooting course teaches diagnostics and fault finding techniques to reduce downtime. Fee: Token Ring Networks (3 days) $1,445; Troubleshooting Token Ring Networks (1 day) $350. Enquiries — IIT Training Tel: (02) 252 2844 Fax: (02) 247 1048.

9-12 **LAN-WAN Asia '93**, Kowloon Shangri-La Hotel, Hong Kong. This top-level summit looks at the new choices for public networks and the planning issues facing large corporate and government private networks in the Asian region. It will examine how technologies like ATM, frame relay, FDDI, SMDS, SDH and Broadband ISDN inter-relate, and provide an update on global standards. There will also be three half-day workshops on frame relay, SNA internetworking and ATM. Fee: Three-day conference $US1,795; conference plus 1 workshop $US1,995; conference plus 2 workshops $US2,195. Enquiries — IIR Conferences Tel: (02) 954 5844 Fax: (02) 959 4684.

10-12 **Network Cabling Design**, The Sheraton Hotel, Melbourne. This hands-on course will explain the cost-effectiveness of various media, cabling standards, construction and transmission methods, regulatory constraints on in-building wiring, preparing cost estimates and future trends. Fee: $1,445. Enquiries — IIT Training (02) 252 2844 Fax: (02) 247 1048.

15-16 **ATM '93**, Sydney Renaissance Hotel, Sydney. This event provides delegates with the latest information on making the transition to ATM technology, and features experts who will discuss how to seamlessly integrate local and wide area networks through ATM. Fee: $1,295. Enquiries — IIR Conferences Tel: (02) 954 5844 Fax: (02) 959 4684.

16-18 **Middle East & Gulf Mobile Communications — Implementing New Digital Mobile Communications Systems**, Inter-Continental Hotel, Dubai. Concentrating on GSM and being held at a critical time in the region's development of mobile systems, this conference will examine operational experiences with the implementation of GSM cellular networks, the issues surrounding standards and roaming, and the future impact of other mobile services. A technical day will allow delegates to understand the practicalities of building a successful and profitable network. Enquiries — IBC Technical Services Tel: +44 71 637 4388 Fax: +44 71 631 3214.

17-19 **Client Server Computing**, Hotel Nikko, Potts Point, Sydney. This event takes an in-depth look at client server computing technology, and shows how the move to client server can improve efficiency and business competitiveness. A one-day workshop will feature a realistic case study to examine design and implementationi ssues. Fee: two-day conference $1,295; conference and workshop $1,895; workshop only $795. Enquiries — IIR Conferences Tel: (02) 954 5844 Fax: (02) 959 4684.

28-1/12 **ACOFT-18 '93**, Northbeach Parkroyal Hotel, Wollongong. The 18th Australian Conference on Optical Fibre Technology will cover the latest research, developments, production applications and business strategies of optical fibres, waveguides, sources, detectors and other services for the telecommunications and sensors industries. A trade exhibition will be held in conjunction with the conference. Enquiries — Conference Secretary, IREE Tel: (02) 327 4822 Fax: (02) 362 3229.

30-4/12 **Vietnam Telecomp '93**, The Vietnam Exhibition and Fair Centre, Hanoi. This exhibition covers telecommunications, computers, broadcasting and office equipment, and gives exhibitors a chance to break into Vietnam's telecoms and data communications markets. Last year the event attracted over 30 vendors from 14 countries. Enquiries — Adsale Exhibition Services Tel: +852 511 0511 Fax: +852 507 5014.

March 1994

10-13 **Telemex '94 and Elec-com '94**, Putra World Trade Centre, Kuala Lumpur. The Telemex '94 exhibition will display state-of-the-art business automation and telecommunication systems, while the Elec-com '94 exhibition is targeted at the rapidly growing market of electronics and computer users, and will feature the latest products in these fields. Enquiries — Excel Exhibitions Tel: +60 3 244 0669 Fax: +60 3 244 0670

April 1994

25-29 **Africa Telecom**, Cairo International Conference Centre, Cairo. The theme for this year's conference is 'Integrating Africa Regionally and Globally,' and the event will cover topics from telecommunications financing and investment in Africa, regional tariff structures, infrastructure development and broadcasting, to appropriate telecommunications technologies and strategies for remote area. Fee: SFR1500. Enquiries — ITU Africa Telecom 94 Forum +41 22 730 5811 Fax: +41 22 730 6444.

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